THE LOST ART OF LEARNING

A pocket guide to mastering learning

DANIEL N. WILKE, Ph.D., Pr.Eng.

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DEDICATION

This book is a tribute to the unsung teachers of the world - children. Often overlooked, they are the genuine custodians of the "Lost Art of Learning", effortlessly mastering it.

I dedicate this book to my teacher, Yüjèn, who so clearly showed me the true path of learning by demonstrating it day in and day out. It took me nearly two years to finally understand, appreciate, and embrace the fundamental principles and skills that govern learning. You silently taught me this without fail - thank you for demonstrating "The Lost Art of Learning" so clearly and repetitively, allowing me to rediscover it again through your eyes.

Danke Hazelmaus - Thank you, Yüjèn.

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ACKNOWLEDGMENTS

To my wife, Ella, who guides our daughter's life by embracing and practising "The Lost Art of Learning" under stressful circumstances – a true master - executing it in her stride – thank you.

I wanted to finish this book in 2020, but the loss of my father, Ntate, and my sister, Notske, nine months apart, made it very hard for me. Remembering them now, I am thankful for the time we had. They taught me how precious life is.

Finally, I would like to acknowledge all the great thinkers, teachers, mentors, and people who have helped me improve my life. Thank you, vielen Dank, baie dankie, dhanyavaad, toda raba - for the special memories and everything you contributed: Richard P. Feynman, Carl Sagan, Christopher Hitchens, Ted Belytschko, Olgierd Zienkiewicz, Jan A. Snyman, Albert Groenwold, Schalk Schoombie, Ms. van Niekerk, Mr. Arendse, Jan-Albert van den Berg, and Julia van den Berg.

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I. PREMISE

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KNOWLEDGE IS POWER. INFORMATION IS LIBERATING. EDUCATION IS THE PREMISE OF PROGRESS IN EVERY SOCIETY, IN EVERY FAMILY

KOFI ANAN

When I thought of this book, I was frustrated and desperately trying to find answers as to why the learning I saw happening in classrooms looked as if it was unravelling at the seams.

More and more students starting courses seemed to have misconceptions of the main points and concepts that previous courses were expected to have developed.

After exploring my own experiences and struggles to understand how learning works, the main idea in this book came about. I started to conceptualise the ideas in this book whilst being a very sleep-deprived dad, a budding researcher, and a passionate lecturer, all whilst teaching my many students. Even through all the hours of lost sleep, of which I am still recovering, this journey of unpacking it all was worth every minute. This book is based on what I figured out by trial and error from gathering data and trying to make sense of it all. It is not based on formal educational ideas or educational theories.

I wrote this book to be short and clear because its main message is too important to be hidden in a very long book. I believe that this book will change the way we view learning and, ultimately, the way we learn. It simplifies many learning ideas into one main concept without discarding all the work done by researchers before me.

I hope to make the concept of learning practical, help people identify how we learn best, and bring back the joy of learning efficiently. I hope it will become instrumental in developing the next generation of curricula, educators, and learners.

In this, I have come to call the idea in this book "The Lost Art of Learning".

I truly hope you enjoy reading this book as much as I did in writing it.

II. SUMMARY

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A CRITIC CAN ONLY REVIEW THE BOOK HE HAS READ, NOT THE ONE THAT THE WRITER WROTE

MIGNON MCLAUGHLIN

This book is about a special ability that helps us learn better. The writer unifies many ways of learning into one simple skill, "The Lost Art of Learning." This skill we all 'used to have' but some of us have forgotten. Using observations in and out of the classroom, from experiences in his own life as a kid, student, teacher, husband, and dad, the writer aims to explain how we can get back this special skill and way of learning.

This 'special skill' can also be applied to many fields in life, such as:

1. *How to help you learn.*

2. *How to make online learning more effective.*

3. *How to be better leaders.*

4. *How to accept changing situations.*

5. *How to navigate when things are unsure.*

6. *How to spot wrong information.*

7. *How to help your mind feel good.*

8. *How to help you grow as a person.*

In writing this book, the writer explains why people achieve different outcomes when they learn, even when they try hard or are in the same classroom. It is written for students who try but need to understand better. This is for teachers who want to teach better and parents who worry about their children's learning. It is written for people who make study materials and design syllabuses and those curious about growing. It is written for people who want to know what makes them different and for anyone who wants to learn better.

This book is based on one idea: to learn to understand the "Lost Art of Learning." It develops strategies for understanding effectively and gives tips for enjoying learning and getting good results. You will grasp the difference between just doing things and deeply understanding something. By developing this one skill, the writer believes you will get better at learning.

Through reading this book, the writer cautions you to apply this 'forgotten skill' daily. It is up to you to use what this book teaches.

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III. WHO SHOULD READ THIS BOOK?

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THE SIZE OF YOUR AUDIENCE DOES NOT MATTER. WHAT IS IMPORTANT IS THAT YOUR AUDIENCE IS LISTENING

RANDY PAUSCH

Have you ever wondered why children and scientists 'learn so well'? Or why does explaining things to others help us understand things better? Why do some schools, such as Montessori schools, differ from regular ones? Why are children's stories and quotes used to teach us things about life? As a scientist myself, I often ask these questions, too. In observing my daughter and others, I started drawing connections between children's stories, quotes, how we explain, my research, and some inspirational thinking of famous scientists that developed into "The Lost Art of Learning". I believe that this book is for...

YOU

Have you ever considered why some people understand things differently even when they spend the same time learning? Why do some kids learn tricky things easily? Are there special ways that make learning easier? Or do you sometimes feel learning is too hard? Are you motivated to learn but demotivated by your results? Do you sometimes learn better than other times and do not know why? Do you have ideas about learning and want to see whether they agree with this book? Are you curious about a special way of learning called "The Lost Art of Learning"? Do you want to make the most of your time and get better at things in life? Do you think there is a 'trick' to learning? If you said "yes" to any of these, this book is for you.

PARENT

Are you worried because your child has a hard time learning? Do you find it easier to understand than your child and wonder why? Do other kids do better than your child in learning? Does your child learn slower than younger kids? Does your child's learning sometimes impress you and other times frustrate you? Do you want your child to adjust well to a changing world? Do you wish for your child to enjoy learning? Do you want your child to think for themselves and not just accept everything they hear? If you said "yes" to any of these, this book is for you.

FRUSTRATED LEARNER

Do you feel like you are doing a lot of homework but not learning much? Are you getting lots of homework without knowing why? Do you have to remember things without really understanding them? Does math feel pointless? Do your math classes focus on just doing problems without understanding them? Does your teacher give you homework but does not

explain why? If so, read this book and share it with your teacher. Take action to get the learning you deserve, where you can grow and learn to think and understand better.

EDUCATORS

Do you want to make a real difference for the next generation? Do you feel like things are not working in the classroom? Want to be a great educator, not just a popular one? Are you setting homework for your learners without clear learning outcomes? Do you struggle to motivate your students why they must do some homework or projects? Do you have trouble figuring out how much homework is too much? Do you always have too much to teach and insufficient time to teach it? This book is for you. It is not about being liked because of easy tests. It is about truly helping students learn. This book will help you use a special way of learning in your teaching called "The Lost Art of Learning". By using this method, you can change the way students learn significantly. So, read this book to find out how to truly help your students.

CURRICULUM ARCHITECT

Are you someone who designs a school syllabus? Do you want to enhance them year on year? Do you want your courses to teach more than just facts? Need help planning the content and examples? Or are you unsure about how to create a good syllabus? Do you want to focus or find a golden thread for your syllabus? Do you know what your syllabus should teach but not how it should be taught? Do you struggle to balance ideas, principles, concepts, and too many applications? Then this book is for you. It will help you make a better syllabus for both teachers and students.

EMPLOYEE

Do you know co-workers who learn faster or understand more than you, even if you spend the same time on a task? Do you want to learn new things better at work? Does your job require you to learn new skills regularly? Do you have trouble getting ahead in your job? Are you a professional that requires continuous professional development? Are you more skilled at your hobby than your job, and does it frustrate you? Even if you have not thought about these questions, if they sound like something you can relate to, this book is for you. If not, you can still read this book. It reads quickly, then share it with someone who might need it. Once you understand the main idea

of this book, you will not easily forget it.

CITIZEN OF THE WORLD

"The Lost Art of Learning" helps make a better society where people care for each other and the environment. It is a skill everyone should be reminded of. The more people know about and practise it, the kinder and smarter our community. If you like this book, share it with someone. Each person who learns this skill helps make the world a better place.

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BEING HUMAN IS GIVEN. BUT KEEPING OUR HUMANITY IS A CHOICE.

UNKNOWN

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IV. PLANTING A SEED

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HE WHO HAS A WHY TO LIVE CAN BEAR ALMOST ANY HOW

FRIEDRICH NIETZSCHE

In 2018, I introduced "The Lost Art of Learning" at a teaching seminar. Many researchers and lecturers enjoyed the talk and the ideas presented. After that, colleagues started building on the idea in their classes, homework, study materials, assignments, and projects. Some learners engaged with the idea intensively, achieving reliable learning success. As the first-year Mechanical Engineering guardian, I reminded new learners about "The Lost Art of Learning". I gave them helpful tips, guiding the learners and even more of my colleagues to adopt them in their lecturing, assessments, and research.

Talking to other teachers and lecturers worldwide, I discovered that many have forgotten the art of learning. But, in the mere mention of the principle behind "The Lost Art of Learning", many respected lecturers and teachers started to adopt it in their courses to teach better. For me, there is a growing problem of students getting higher grades for lower understanding of their subjects' principles, ideas, and concepts. I have seen some teachers aim for good student feedback by mainly teaching what will be tested. This creates a false perception in learners who think they have learned a lot when, in essence, they have just memorised, resulting in 'fake' learning.

Instead of focusing on deep understanding, students often only want to pass tests and exams. If a test is easy, they might even think they have gotten a good education. This is worrisome, as students focus on passing exams and teachers focus on receiving good student feedback, which can snowball into an unhealthy learning environment. Poor assessment practices can create the illusion of "successful" learning, leaving the learners duped into believing they were well educated. Hopefully, this book helps bring balance to this educational madness.

I decided to include some content on teaching and syllabus development in this book because, for many, using "The Lost Art of Learning" in teaching was hard. Others found properly understanding it to be quite tough. I wanted to make it easy for everyone to understand and use it. I gathered that bad assessment practices, limited ideas, insecurities, self-deception, lack of leadership, politics, egos, complaining parents, and students just wanting to pass often made "The Lost Art of Learning" harder to establish as a healthy learning environment. This "new way" will challenge old-school teaching methods and bad assessment practices developed between teachers and students.

To understand deeply, you must face your fears honestly and truthfully. Lying to yourself makes learning, teaching, and even growing harder because what is there to learn when you already “understand” everything?

V. FINDING VERSUS FILTERING

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EXTRAORDINARY CLAIMS REQUIRE EXTRAORDINARY EVIDENCE

THE SAGAN STANDARD - CARL SAGAN

Our world is changing fast, and things are becoming more unpredictable and complicated. To survive and succeed, we need to adapt. What makes us valuable is our ability to add value through services, products, and entertainment.

Today, new technologies, like Artificial Intelligence (AI) tools such as ChatGPT, LLaMA, and DALL-E, are taking over certain human tasks. These technologies mean we must be more creative and think differently to stay valuable and keep offering value and meaning. Modern life is convenient. We can order products and services with our phones, and they come right to our door. We can shop without waiting in line and get personalised entertainment suggestions. We can ask questions and get immediate responses at any time of day or night. We can quickly find information on almost anything, and nearly everything finds us effortlessly.

Some say that getting things instantly makes us less patient and less focused. We might even lose the ability to deeply understand things because we are used to quick answers, immediate services, and instant solutions.

In the past, our challenge was to find information. Now, we have too much information. Information shifted from finding to filtering. Younger people are growing up in a time where information is everywhere, yet they might not know how to check if it is true or false. Instant personalised and constructed information makes it more difficult to tell the difference. In our current society, understanding the origin and intent behind information is almost more important than the content itself. We need to check facts constantly to avoid being tricked, and we are still getting caught. Finding the truth in an information-saturated world is challenging, where the truth is painted as the exception and fabrications as the ordinary. Sadly, these distorted values are steadily infiltrating our behaviour towards one another.

In my experiences over the last few years, I have come to see that "The Lost Art of Learning" really helps us to understand things, which helps us to manage and process things, not just in school but also in life. It helps to differentiate between the truth and the lies. It allows us not just to know the facts but truly grasp ideas at their core and to figure out what information we need to hold onto and which ones to let go. Knowing how to learn well helps us deal with our changing world. It allows us to use changing technologies rather than being used by technologies. This makes us better prepared for the future. This, in turn, is also very important for our minds and mental health, as clarity on information truly makes you filter out what is important, allowing you to plan and prioritise your life as opposed to being planned and prioritised by others or algorithms.

VI. THE REVEAL

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NAME IT TO TAME IT

DR DAN SIEGEL

I am about to share the forgotten secret about learning and deep understanding. Can you guess what it is? As you have been reading this book, this secret way of learning has been at play throughout.

This 'special way' of learning is how kids learn by trying things and how big scientific discoveries are made. It is similar to the learning method - when you teach or explain things to others. It is found in children's stories, famous sayings, and some schools, making some people great thinkers and researchers. You are doing it partially as you think about my question. Do not worry if you are not sure of the answer. Every kid knows this way of learning, and most experts do it all the time. Yet somehow, some schools and teachers have forgotten about it.

Are you excited to find out? I am feeling excited to share it with you!

Albert Szent-Gyorgyi's thoughts on discovery and research are summed up in this quote:

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RESEARCH IS TO SEE WHAT EVERYBODY ELSE HAS SEEN AND TO THINK WHAT NOBODY HAS THOUGHT

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The "Lost Art of Learning" is based on Albert Szent-Gyorgyi's idea about research:

◆◆◆

LEARNING IS TO SEE WHAT EVERYONE ELSE HAS SEEN AND TO REFLECT WITH INTENT UNTIL IT IS UNDERSTOOD

◆◆◆

What is reflection with intent? Reflection is the iterative process of questioning and clarifying by finding meaningful explanations. Note: It is not about finding answers but explanations you understand, i.e., reasoning and logic. Hence, it is not about finding and remembering an answer without understanding it. Intent is when we ask questions focusing on obtaining clear outcomes, in this case, better understanding and clarity.

"The Lost Art of Learning," or reflection with intent, is the iterative process of asking good questions to develop clear explanations that help us understand better. With every iteration, we ask a new focused question that identifies an aspect of our understanding that we want to improve. This is what reflecting with purpose, meaning, and focus, as well as critical reflection or reflection with intent, means. You may ask, why is learning to understand iterative? The answer, in my opinion, is very simple, because we are human. It is the nature of our neurology that we need to iterate from different angles and approaches to ensure we develop a strong neurological web of paths that manifests as understanding and clarity. The only shortcut to understanding and clarity is to iterate effectively.

It is not just about casually thinking back on things often associated with reflection but doing so with focus and clear goals. In homework assignments or workshops, people often say 'reflect' or 'think', but they do not guide you on how to do it with purpose and intent. Many people just hit a blank when asked to 'reflect' or 'think'.

"The Lost Art of Learning" focuses our mind on learning with the intent to understand. It makes sure that when we learn, we have a clear goal in mind. It says that, instead of memorising facts, it teaches us to value the understanding of principles, ideas, and concepts. The more deeply we think and the clearer the intent, the better we understand and the simpler what we need to understand becomes. By doing so, we package many examples, class

notes, classroom discussions and a mixture of data in various formats into only a few core ideas, concepts, and principles, which we can then use to solve diverse problems within multifaceted contexts. Mastering these core ideas, concepts, and principles allows us to generalise them to new applications and unchartered contexts, forming the primary basis for many researchers.

Reflection with intent is the iterative learning process aimed at understanding and obtaining clarity. It creates a learning loop as we encode and unpack what we understand to identify weak spots in our understanding and clarify ideas, principles, concepts, applications, and topics. We don't learn or understand things well without this iterative deep questioning and thinking.

In today's world, many books teach us how to learn. They advise changing your lifestyle, food habits, motivation, focus, and mindset. These books give many examples but can be hard to follow because they give many steps before success. It is hard to know what to change if you do not see results from following all these steps. Could it be the wrong diet, mindset, or habit? Did I get the order wrong?

This book is different by telling you exactly what you need to do: ask focused questions that force you to think or figure out meaningful explanations that improve your understanding. All the tips and tricks I will discuss in this book are just different ways to figure out how to ask useful questions and find meaningful explanations.

Reflecting with intent is how young kids learn as they try new things and learn from their mistakes. Famous researchers do it daily to make big discoveries or obtain profound insight. The main idea behind this is a famous study method, the Feynman technique. By explaining something to someone else, you must constantly ask how this can be explained better or more clearly. Montessori schools follow the child and let them engage with questions which they need to figure out. Even simple children's stories can teach us deep lessons when intentionally reflecting. Quotes become meaningful. Many famous people in history were known and are still celebrated today for their ability to ask the right questions and find meaningful answers, from ancient philosophers to modern scientists.

All learners, from little kids to researchers, can ask focused and meaningful questions, conduct simple studies, and apply deep thinking to find meaningful explanations. Schools and teachers can develop this way of learning through lessons and assessments, and parents can model this in their

conversations with their children.

Learning is like a journey, and reflection with intent is the vehicle. The motivation to become better and better is the fuel. This learning journey helps us to understand new ideas until they are clear in our minds. Without repeatedly practising focused questioning, obtaining good evidence, and deep thinking, we do not truly learn or get clarity with certainty. We then end up memorising things that we do not understand. Sadly, this has become common in many schools and various parts of society.

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VII. CURRENT STATE OF AFFAIRS

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THE PAST HAS NO POWER OVER THE PRESENT MOMENT

ECKHART TOLLE

The Lost Art of Learning" is slowly disappearing from schools, colleges, and universities. Probably because of how quickly we can find answers online. This makes it harder for people to understand deeply as finding information gets confused with understanding. Some research shows that people's thinking abilities increased until about 1975 (Flynn effect), but then decreased slowly. However, this topic is complicated, and many factors could affect it. Likely contributing factors include thoughtful women who used to teach and are now choosing other careers, and rightfully so.

Let us entertain the premise that 'people's thinking' abilities are deteriorating for a few minutes. I believe "The Lost Art of Learning" is why we see this decline. Instead of reflecting with the intent to solve problems, people are searching to find answers online. Schools also focus more on teaching students how to follow recipes, memorise, and find facts instead of encouraging students to think and filter for themselves. Some teachers even consider thinking in assessments as unfair assessment practices instead of developing children's ability to think for themselves. Unfortunately, these teachers can even drive the development of syllabi and curricula at schools, colleges, and universities, often empowered through politics and poor leadership.

To add to the chaos, technology makes it seem like 'deep thinking' and 'truly understanding things' are not as important anymore. New teaching methods are used in schools without being based on understood principles, often unknowingly eliminating any development of critical questioning, reasoning to explain, and deep thinking to consolidate. Instead of understanding and developing learning, people copy what they see and hear without questioning it. Teachers who do not actively develop thinking in their classes and through their assessments have sent shivers down my spine. Unfortunately, this happens more often than it should. This makes 'following steps without thinking' look like 'real learning', replacing understanding with imitation.

Kids naturally learn properly, but some schools ruin this by using bad teaching and assessment practices that do not develop critical thinking with clarity and intent. Some learners struggle so much that they feel hopeless and make very sad choices. At some universities, students are conferred Master's and Ph.D. degrees because supervisors try to meet career goals. The quality of student development, growth and research within these degrees is sometimes ignored or brushed aside. In extreme cases, a Master's research can only reflect the supervisor's ability. Some Ph.D. students, instead of developing, growing, and reflecting on their research, continue this reliance on their supervisors every single step of the way. Hence, a Ph.D. can be

conferred for completing a long Masters.

Adding to the confusion is a general breakdown in basic integrity and morals, where some faculty and students will happily claim others' contributions as their own without giving due credit. Junior and senior academics sometimes empower this behaviour for the same gain.

The greater danger is that we are cultivating "experts", "researchers", "teachers", "educational experts", and "syllabus developers" who do not understand anything deeply, have never developed critical thinking, and have never really understood themselves deeply. They can become teachers, lecturers, and even professors without developing the ability to think deeply and clearly.

Performance pressures on schools and universities create the perfect educational storm. Schools and universities want high pass rates for subsidies, throughput, and the perception of quality. It is becoming a numbers game, and it is happening around the world. Yet, in this way, students are not truly learning; they do not understand and never develop the ability to think at a higher level as they get increasingly lost in the wider educational sphere.

A few lucky people figure out how to learn to understand and obtain clarity as adults, but this is often rare and by chance. By talking about "The Lost Art of Learning," I hope to help people learn to understand deeply and give them the courage to guide teachers on how to teach and assess more effectively.

This book is a handy guide to help those struggling to cope with this educational confusion and madness.

VIII. DOING VERSUS UNDERSTRANDING

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I HEAR AND I FORGET. I SEE, AND I REMEMBER. I DO, AND I KNOW. I CRITICALLY REFLECT, AND I UNDERSTAND

ADAPTED FROM CONFUCIUS

Questioning and clarifying deeply and with a clear goal is very important. "The Lost Art of Learning" makes us question ourselves to truly understand things, no matter what our beliefs. It might seem tough at first, but it is useful. To use this way of learning, we need to observe our feelings and aim for real understanding, not just pretending or remembering things without understanding.

Let us see how we can get better at "The Lost Art of Learning", which is about questioning and clarifying deeply with the clear goal of understanding better. It is comforting to know that we (as older learners) all had this skill at one point or another. This book helps you to relearn this skill we had all previously mastered. To learn, we must follow three main steps: 1) questioning, 2) doing, and 3) clarifying. Questioning articulates the focus, providing evidence and clarifying to make sense of the evidence, allowing us to explain it and improving our understanding. Doing only provides the evidence, but it can easily be completed by imitating, copying, or memorising. The learning requires us to think deeply and critically about the evidence to logically explain our focused question. Even for provided but poor questions, we can think about what we did, how we did it, and why we did it to turn them into more meaningful questions. By doing this, we deepen our understanding and sometimes come up with new ideas.

Let me use a technical example to show how learning can be circumvented or can really take place. Let us start with a question. What is Potential Energy? Think about the formula for Potential Energy = mgh (where m is Mass, h is Height, and g is the Gravitational Acceleration). Now, the doing part is simple: I multiply m with h with g ($m.g.h$) and get the answer for the Potential Energy. (That is the easy part, by the way).

We can use the formula as evidence of how Potential Energy is modelled and use it to provide evidence through some basic calculations. However, learning only starts when we make sense of the evidence by thinking about formulas or calculated answers. Only then can a deeper understanding be taken into account in knowing how these three components contribute towards storing energy. (A 50-litre water bucket that is 3 meters up in the air and a 25-litre water bucket that is 6 meters up in the air store the same amount of energy – yes, both buckets are full of water. The same water bucket must be around six times higher on the moon to store the same amount of potential energy as on Earth.)

The main point of "The Lost Art of Learning" is this: just doing something does not mean we have learned anything. True learning comes when we try to make sense of the evidence that the doing provided by

articulating what we learned, how we learned it, why we learned it, and what changes when situations are different. In other words, experience alone is not enough, as it only provides evidence. We must think about the evidence in meaningful ways as we aim to explain the sense of it, thereby effectively articulating what we have learned from it.

The American philosopher and educational reformer John Dewey said:

> *WE DO NOT LEARN FROM EXPERIENCE... WE LEARN FROM REFLECTING ON EXPERIENCE.*
>
> *JOHN DEWEY*

When we only focus on doing things without thinking about what the doing provides, we miss out on real learning. It is like blindly following a recipe without understanding why we do each step or reciting a poem in a foreign language that we do not speak.

True learning happens when we think about what we did and why we did it. If we finish tasks without thinking about them, we do not learn much.

Many students try to complete lots of tasks instead of trying to learn lots of lessons from each task. Many teachers only assess students' ability to do as it grades easily, as teachers already have too much to do. This is how easily actual learning gets ignored.

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IX. ROADMAP

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FOR THE SOLE TRUE END OF EDUCATION IS SIMPLY THIS: TO TEACH MEN HOW TO LEARN FOR THEMSELVES, AND WHATEVER INSTRUCTION FAILS TO DO THIS IS EFFORT SPENT IN VAIN

DOROTHY SAYERS

AUTHOR OF THE LOST TOOLS OF LEARNING

To truly learn, we need to provide explanations to meaningful questions by making sense of evidence provided as information, the outcomes from doing, and experience. This means we need to develop an iterative learning process that explains answers instead of online searches that merely provide answers.

Questioning things and making sense of lots of conflicting information is a very important skill in today's world. It differentiates family dinner conversations. If people can think deeply, they are more likely to succeed, given their circumstances. Critical reflection helps to level the playing field as it allows you to be prepared by your past and not to be defined by it (adapted quote from Joel Osteen).

To get better at this and to move forward in life, we need to be okay with taking time to think and not just accept whatever we get. Both teachers and students can benefit from this approach. In reading this book, I hope that both better understand each other's roles and intent in the learning process.

If you are a student and feel like you are not learning well, you can use this book to help your teachers help you. Remember, everything in school is meant to let you learn and grow. But just because someone wants to help does not necessarily mean that they know of the best ways to do it.

Teachers sometimes teach the way they were taught, even if it is not the best way. They might not know of better ways to teach. If you are not learning in a classroom environment, it is important to speak up. Not only can it help you but also future students and even your kids, as the next generation of teachers will teach them.

Teachers must develop students' ability to reason, not just to memorise recipes and remember facts. It is good for teachers to show their thought processes and share their questions and critical reflections on available evidence. If required, how to extend the evidence systematically. This helps students relate and understand better. Showing that understanding comes from thinking deeply by making sense of evidence to explain meaningful questions. The outcome is that we can generalise what we have learned to new situations and circumstances as opposed to being limited by only being capable of regurgitating solutions of worked-out examples. It does not come from being smart. This can help students feel more confident whilst they explore new and interesting topics.

Questioning things and thinking deeply are skills you can get better at, like getting healthier when exercising and improving at a sport by playing the sport. To help you get better at this, I will share seven tips that have worked

for me. They are:

1. *Talk, Explain, and Teach*
2. *Summarising versus Generalising*
3. *Double-Up, Extremes, and Baselines*
4. *Values versus Variables*
5. *Sanity Checks, Order Estimates, and The Bottom Line*
6. *Forcing Quotes and Jokes*
7. *Role-Playing and Swapping*

PROOFREAD

1. TALK, EXPLAIN, AND TEACH

THE ULTIMATE TEST OF YOUR KNOWLEDGE IS YOUR CAPACITY TO CONVEY IT TO ANOTHER

RICHARD P. FEYNMAN

Talking, explaining, and teaching develop your ability to clarify and explain what you have learned from engaging with questions that may not always have obvious answers. Rhetorical questions appear whenever you stumble or struggle to convey an idea, principle, or concept in simple terms, allowing you to zoom in on what is least understood.

Hence, the Feynman technique helps you to question critically and think deeply to clarify and understand things better. It is about elevating talking to explaining and finally to teaching for better understanding. If you cannot explain something in simple terms, then you might not truly understand it yourself. Some people might be more confused than others, but by explaining what you understand, you can isolate and focus on the confusion.

The key is "explaining things simply". If you cannot start explaining, you might just be copying what you have heard without really understanding any of it. If you get stuck or must go back while explaining, you might not be clear on the main idea. But when you talk and explain TO TEACH, you understand better and develop that understanding the more you explain to teach. The simpler and clearer you explain, the better you teach and the better you understand. Phil Collins's song with the lyrics of Son of Man states: "In learning you will teach, and in teaching you will learn".

The Feynman technique is a good way to see where you still need to learn more. A productive way is to talk with other students, colleagues, and peers during your free time to find out what you understand and where you should focus more time and energy on reflecting with intent.

Richard Feynman's quotes elegantly capture this technique by saying: do not be scared but be curious to question and reflect with purpose, meaning,

and focus, to think deeply. Look at some of his quotes that are favourites of mine. Think deeply about how they tell us to use and apply the Feynman technique:

I LEARNED VERY EARLY THE DIFFERENCE BETWEEN KNOWING THE NAME OF SOMETHING AND KNOWING SOMETHING

WITHOUT USING THE NEW WORD… TRY TO REPHRASE WHAT YOU HAVE JUST LEARNED IN YOUR LANGUAGE… WITHOUT USING THE WORD… TELL ME WHAT YOU KNOW

THERE IS NO LEARNING WITHOUT HAVING TO POSE A QUESTION. AND A QUESTION REQUIRES DOUBT

I WOULD RATHER HAVE QUESTIONS THAT CAN'T BE ANSWERED THAN ANSWERS THAT CANNOT BE QUESTIONED

STUDENTS SHOULD BE MADE TO THINK, DOUBT, COMMUNICATE, QUESTION, LEARN FROM THEIR MISTAKES, AND, MOST IMPORTANTLY, HAVE FUN IN THEIR LEARNING

YOU KEEP LEARNING AND LEARNING, AND PRETTY SOON, YOU LEARN SOMETHING NO ONE HAS LEARNED BEFORE

PROOFREAD

YOU CANNOT GET EDUCATED BY THIS SELF-PROPAGATING SYSTEM IN WHICH PEOPLE STUDY TO PASS EXAMS AND TEACH OTHERS TO PASS EXAMS, BUT NOBODY KNOWS ANYTHING. YOU LEARN SOMETHING BY DOING IT YOURSELF, ASKING QUESTIONS, THINKING, AND EXPERIMENTING

KNOWLEDGE IS NOT FREE; YOU HAVE TO PAY ATTENTION

Using Feynman's method, we might still trick ourselves into thinking we understand when we do not. When we want to finish fast instead of really understanding deeply, self-deception can be at play. It can be hard to admit that we do not know something, but managing our feelings can help. It is good to be okay with having questions and not knowing everything right away. There is an opportunity to turn confusion into understanding and growth by finding ways to provide evidence that helps us make sense of what is going on.

Richard P. Feynman shared thoughts about not being sure and fooling ourselves, which echo in his own words. After reading each quote, think about how you feel about not being sure or having doubts. Do some quotes make you feel better, and others do not affect you much?

THE FIRST PRINCIPLE IS THAT YOU MUST NOT FOOL YOURSELF, AND YOU ARE THE EASIEST PERSON TO FOOL

SCIENCE IS WHAT WE HAVE LEARNED ABOUT HOW TO KEEP FROM FOOLING OURSELVES

FAILURE IS AN INCREDIBLE LEARNING EXPERIENCE. IT TEACHES YOU HUMILITY. IT TEACHES YOU TO WORK

HARDER. IT IS THE FIRST STEP TO UNDERSTANDING

AS I GET OLDER, I REALISE BEING WRONG ISN'T A BAD THING LIKE THEY TEACH YOU IN SCHOOL. IT IS AN OPPORTUNITY TO LEARN SOMETHING

I DON'T FEEL FRIGHTENED BY NOT KNOWING THINGS. IT IS MUCH MORE INTERESTING

WE ARE TRYING TO PROVE OURSELVES WRONG AS QUICKLY AS POSSIBLE BECAUSE ONLY IN THAT WAY CAN WE FIND PROGRESS

NEVER CONFUSE EDUCATION WITH INTELLIGENCE. YOU CAN HAVE A PHD AND STILL BE AN IDIOT

RELIGION IS A CULTURE OF FAITH; SCIENCE IS A CULTURE OF DOUBT

These quotes can help you think and maybe help with your feelings when you are trying to understand things. If you need motivation, put the ones you like on a wall.

Inspiration is the fuel for perspiration, with some shared thoughts from Feynman on the matter:

NOBODY EVER FIGURES OUT WHAT LIFE IS ALL

ABOUT, AND IT DOESN'T MATTER. EXPLORE THE WORLD. NEARLY EVERYTHING IS REALLY INTERESTING IF YOU GO INTO IT DEEPLY ENOUGH

YOU HAVE NO RESPONSIBILITY TO LIVE UP TO WHAT OTHER PEOPLE THINK YOU OUGHT TO ACCOMPLISH. I HAVE NO RESPONSIBILITY TO BE LIKE THEY EXPECT ME TO BE. IT'S THEIR MISTAKE, NOT MY FAILING

I... A UNIVERSE OF ATOMS, AN ATOM IN THE UNIVERSE

RICHARD P. FEYNMAN

PROOFREAD

2. SUMMARISING VERSUS GENERALISING

TO THINK IS TO FORGET DIFFERENCES, GENERALIZE AND MAKE ABSTRACTIONS

JORGE LUIS BORGES

Summarising versus generalising is effective in systematically guiding you through questioning to find the core and main ideas from lots of complex data and information. Instead of providing evidence, you aim to reduce the provided evidence to a few general ideas, concepts and principles.

Summarising helps you focus on what you are learning. But if you shorten the information without understanding, it is not helpful at all. Good summarising means picking out the main ideas.

To check if you have the main ideas, see if you can use what you learned in different situations.

The story "Little Red Riding Hood", written by Charles Perrault and the Brothers Grimm, can help explain the idea. If you do not know the story, you can find it online to read or listen to. It is a simple story that many people know.

Let us continue, a "mindless" summary of the story might sound like this:

1. *A little girl lives at her parents' house.*

2. *The little girl needs to deliver a basket to her grandmother.*

3. *The little girl met a wolf.*

4. *The wolf ate her grandmother.*

5. *The girl thought the wolf was her grandmother.*

6. *The girl realises that her grandmother is the wolf.*

7. A stranger helped the girl and released her grandmother from the bowl of the wolf.

To indicate how summarising can look "mindless", I used ChatGPT 3.5, which provided a summary as follows:

THE STORY IS ABOUT A GIRL NAMED LITTLE RED RIDING HOOD WHO VISITS HER GRANDMA'S HOUSE AND MEETS A WOLF. THE WOLF TRICKS HER AND TAKES HER GRANDMA'S PLACE. IN THE END, THEY ARE SAVED.

Even though the summary has all the main events, we do not learn much from the summary. No lesson generalises behind it.

Instead of just listing events from the story, let us understand the deeper message of 'Little Red Riding Hood' by generalising aspects of the story. A simple strategy for stories is to connect them to real-life situations. The earlier summary did not capture the main lesson. Let us try to include that, this time by asking how aspects of the story would look in real life:

1. Who does Little Red Riding Hood represent? The little girl represents someone innocent and vulnerable that we can relate to in our lives.

2. Who does the wolf represent? The wolf is like a stranger who might look friendly but has hidden bad intentions.

3. What does the basket represent? The basket is like a responsibility or duty that we need to fulfil.

4. What does the encounter represent? When the wolf and the girl meet, it shows us that appearances can be deceiving, and we should be careful about sharing too much information with strangers that they can use to deceive us.

5. What do we learn at Grandma's house? At Grandma's house, we learn that some can deceive us, but some kind-hearted people can come to our rescue when we are in trouble. The key is to determine which ones are which.

This story has some negative ideas about certain groups of people, but I will not elaborate on that. But let us try to sum up the story with one main point. For me, the main point of the story is:

Be careful what you say to strangers.

It does not matter if you agree with the summary or the main point. What

is important is how we think about it. When you read the simple summary, think about its main lesson. Just making a summary does not mean you have learned anything. In fact, a mindless summary can harm you when it misses the main points. True learning is when you think about the summary and ask why it is important.

Try writing your summary and see how it is different from mine. What can you learn from those differences?

A longer summary by ChatGPT 4.0 includes an interpretation of the moral of the story:

LITTLE RED RIDING HOOD IS SENT BY HER MOTHER TO VISIT HER GRANDMOTHER AND BRING HER SOME FOOD. SHE WEARS A RED HOODED CLOAK, WHICH GIVES HER NAME. ON HER WAY, SHE MEETS A WOLF. HE TRICKS HER INTO REVEALING WHERE HER GRANDMOTHER LIVES AND ARRIVES THERE FIRST, SWALLOWING THE GRANDMOTHER WHOLE. HE THEN DISGUISES HIMSELF AS THE GRANDMOTHER. WHEN LITTLE RED RIDING HOOD ARRIVES, SHE NOTICES SOMETHING IS OFF WITH HER "GRANDMOTHER" (REALLY THE WOLF IN DISGUISE). AFTER A BRIEF EXCHANGE WHERE SHE REMARKS, "WHAT BIG EYES YOU HAVE!", AMONG OTHER OBSERVATIONS, THE WOLF REVEALS HIMSELF AND SWALLOWS HER TOO.

HOWEVER, A PASSING HUNTSMAN HEARS THE NOISE, COMES TO THE RESCUE, AND CUTS OPEN THE WOLF, SAVING BOTH LITTLE RED RIDING HOOD AND HER GRANDMOTHER. THE STORY OFTEN ENDS WITH A MORAL ABOUT THE DANGERS OF TALKING TO STRANGERS.

Mindful summarising means always asking why something is important and where else it can be used. This helps us focus on the main points and leave out secondary details. By thinking deeply with intent, we can take lots of information and turn it into a few main ideas.

Children's stories are meant to make children think. The main goal of reading a story to a child is not just finishing the story but asking questions and talking about it afterwards. This helps the child think deeply about the story. This is like how researchers read scientific articles. The level at which children and researchers think might be different, but both are asking questions and thinking about what they read. If you do not let your child talk and ask questions, you stop them from thinking deeply.

If you need more help with notetaking, try the Cornell Note-Taking

System created by Prof. Walter Pauk from Cornell University in the 1950s. He explained it in his book "How to Study in College".

The idea is to use three steps: write down information, ask questions about it, and then summarise what you have learned. To do this, split your paper into three parts for each step. The usual way is to take notes first, then ask questions, and lastly, summarise. But do what feels right for you.

This method helps you to systematically think deeply with intent about what you are learning.

PROOFREAD

3. DOUBLE-UP, EXTREMES, AND BASELINES

WE CONTINUALLY JUDGE THE WHOLE FROM THE PART WE ARE FAMILIAR WITH

WILLIAM EDWARD BURGHARDT DU BOIS

Double-up, extremes, and baselines help to turn doing homework into meaningful learning experiences. Without having to figure out questions to ask, double-up, extremes, and baselines provide a clear path. Without having to figure out what evidence to provide, double-ups, extremes, and baselines provide a clear path. As a result, double-ups, extremes, and baselines allow you to focus your time on understanding without having to fear the questioning. For subjects like Physics and Math, to better understand concepts, you can try this tactic of changing numbers or amounts and see what happens. In technical language, it is called 'sensitivity analysis'. In essence, it is a simple strategy to provide evidence that we need to make sense of.

When you apply this style of learning to your subjects, you begin to engage the students with what they expect will happen. You can ask them to change some numbers, one at a time, and then compare their answers to what they thought would happen. Let them ask themselves questions such as, "Which changes made the biggest difference?" "Why did it happen like that?" And now, instead of just doing Math, they are thinking more deeply about what the Math really means — turning "just doing math problems" into learning from Math problems.

In this section, let us think of 'Velocity' as a simple number: positive if it is moving to the right and negative if it is moving to the left.

Think about this example of doing homework:

Physics principle: Kinetic Energy

Mathematical formula: 0.5 x Mass x Velocity Squared.

Homework 1: Calculate the Kinetic Energy of a 1kg ball travelling at 1m/s.

Homework 2: Calculate the Kinetic Energy of a 1000kg vehicle travelling at 40m/s.

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.

Homework 100: Calculate the Kinetic Energy of a 1g mosquito flying at 0.1m/s.

When you do homework or provide problems such as 1 to 100 about Kinetic Energy, you are merely multiplying numbers. This does not really teach the deep meaning of Kinetic Energy. After doing these problems, you or the student might still not really understand what Kinetic Energy really is. It is easy to get stuck doing work without really learning. Both teachers and students share the blame for this problem in education.

But let us ***think*** *about this example: changing the numbers from the original work.*

Homework 1 establish a baseline: Calculate the Kinetic Energy of a 1kg ball travelling at 1m/s as a baseline.

Reflection 1 using doubling: What happens to the Kinetic Energy when doubling the ball's mass compared to the baseline?

Reflection 2 using doubling: What happens to the Kinetic Energy when you double the ball's velocity compared to the baseline?

Reflection 3 using generalisation to test understanding: *Which car crash is safer?*

1. A car accident with a car of twice the mass but the same speed or

2. A car accident with a car of twice the speed but the same mass?

3. Why?

In the above examples, we did the calculation of three homework problems but then asked three distinct questions. These questions made us think more about the answers. It is not just about getting an answer but understanding and learning from it. We did fewer homework calculations but

thought more about them. This way, we saved time and used our brains better. Instead of just doing math, we thought about the implications of the answers, how they are related and how it applies to life. This helps us understand important ideas that we can use in other areas of our life, not just for calculating Kinetic Energy.

Looking at extremes can help us understand better when we have situations where objects are very small or very large, or we have objects that move very slowly or very fast relative to each other. It highlights for us what starts to dominate and what starts to diminish as we go to the very small and very large numbers. For example, when we square numbers, large numbers become much larger compared to numbers that are not squared. Conversely, squared numbers close to zero are much smaller than numbers that are not squared. What are the implications for Kinetic Energy?

The strategy of extreme comparisons can also be used to reason about things we may know little about. Think about how hard or soft a ball is when you catch it. If someone throws a hard ball and a softball at you, both with the same speed and size, like a marble versus a ball of wool, which one would hurt more? Even if both balls have the same Kinetic Energy, the hard ball might hurt more. Why? The hardball quickly bounces off you, but the softball stays longer in contact as it squishes. This is because of how stiff they are. The faster the ball bounces off, the more it hurts. This idea is related to impulses.

Car designers use it. In the past, cars were made very hard to protect the car. So, people in crashes got hurt, but the car was okay. Now, cars are made to be softer to protect people. In a big crash, the car might be ruined, but the people are safer.

When you have homework, using double-ups, looking at extreme cases, and baseline or extreme comparisons can help you think deeper.

For teachers, using these methods can help students understand new ideas better and think about them in meaningful ways.

4. VALUES VERSUS VARIABLES

TO BE IS TO BE THE VALUE OF A VARIABLE

WILLARD VAN ORMAN QUINE

Values versus variables is an effective strategy to focus questions and develop evidence that elevates your understanding. It enables you to dissect math formulas for the purpose of understanding them.

Math formulas are great tools to help us understand how things work in the world, in our social lives, and even in our daily routines. By studying and understanding certain formulas, and not just memorising them, we can see their importance and use them "to predict" what will happen next. We can begin to use these formulas to pick out the main points from confusing information. We can use them to understand when things change and why they would change. We can even use them to make plans for new things before they are made.

Today, real magicians are scientists who reflect with intent. Instead of using pretend magic, they use maths, facts, and formulas to explain things and predict the future. The best part is that most people can see and understand their work because it is open and honest. Science, in my opinion, is like magic that we can understand. To be like some of these scientists who reflect with intent, you need to appreciate and understand this special knowledge that math formulas bring with them. Math formulas are made of parts we call variables and numbers. Sometimes, we only use variables and other times, a combination of both in these formulas. When we use only variables, they can mean different things and have different sizes or measures based on how we use the formula. Even if two formulas look the same, they can mean different things in different subjects, like physics and statistics.

But the true power in using formulas lies in understanding that sometimes a formula in one area, such as physics, can be applied in another area, such as chemistry. This 'flexibility' allows people to find and explore new ideas by using old formulas in new ways.

Yes, I know that when I say formulas, your brain wants to think of complex, big, scary movie formulas used to crack secret codes... but if we learn in a focused manner and when we study by questioning, clarifying, and thinking deeply, we can take all our knowledge and experience and turn them into simple ideas, concepts, and principles we can understand easily.

Take the example of a 'zip file'. The function of a 'zip file' is to make a whole bunch of files on a computer smaller and easier to send. Just like that, formulas can make big ideas seem smaller and easier to understand. It allows us to see the "bunch of files" (overwhelming complexity) within the "compressed version" (simple and understandable ideas, principles, and concepts). And the more we know about something, the simpler we can make its formula.

When we look at formulas overall, it is good to begin to ask questions about them. What happens when we change this part of the formula? What do different signs or operations (like adding or multiplying) mean? Are there limits on what numbers can be used? Why?

Questioning formulas can show us what the person who made it thought, what tools they had, what questions they were trying to answer, etc. These questions can give us a new way to see and think about the world.

I want to return to our earlier example of Kinetic Energy. Yes, I know this is a book about learning, not Math. Still, in unpacking a formula so easy, yet so powerful, you will begin to appreciate "The Lost Art of Learning" even more (I hope) as we explore the many ways in which questioning these variables can add value to learning.

Our Example

Physics principle: Kinetic Energy

Mathematical formula: **0.5 x Mass x Velocity Squared**

In this formula, mass can only be a positive number, whilst velocity can be either a positive or a negative number. (This positive or negative tells us when something is moving forward or backwards in a straight line.)

Now, we can start by asking the following questions:

- Can energy (the product (answer) of the formula) be either positive or negative?

- Why is the speed multiplied by itself (squared)?

- Why is there a "half" in the formula? And what is its function?

- Should we use "speed" or "velocity"? And what is the difference?

To understand where the "half" (0.5) comes from, we need to think about all the different kinds of energy out there. There is movement energy (kinetic), stretching energy (strain), work energy, heat, light, and more. Among these, "Work Energy" is the closest associated with our formula.

We can think of "Work Energy" by turning it into Kinetic Energy. They are connected because they are measured in the same way. This idea is like how Einstein connected mass and energy, saying mass is a kind of stored energy.

Lastly, the "Work Energy" is calculated by multiplying the force (computed as mass times acceleration) by the distance it moves, but this is for simple cases where the force does not change as it moves:

WORK ENERGY = MASS X ACCELERATION X DISTANCE

**Assuming Constant Force, i.e., Mass x Acceleration is Constant.*

In our example, we are starting from a stop. This means we begin with no velocity. Acceleration stays the same, it does not change over time.

Now, let us think a bit about movement:

- If we speed up evenly, our velocity changes as a simple straight line with time. (The faster I am going, the longer I am moving).

- The distance we travel with this velocity looks like a quadratic curve when we plot it with time. (When we look at how far we have gone and draw a line for it over time, the line will curve quadratically. Why? The steepness of that curved line is our straight-line velocity with time. If our velocity is changing as a straight line over time, our acceleration is constant.)

Now, when we have a force that changes based on how far we have gone, we need to be careful in calculating the total effect. We cannot just multiply force by distance directly. Instead, we need to add up the force little by little over the whole path.

Lastly, the way we find out how far we have gone is by looking at our velocity and how long we have been moving. Hence, we need to multiply

velocity (distance per time) with time to obtain distance. But our velocity is changing as a straight line with time. Hence, we need to multiply every value of velocity with the duration at which we were at that velocity. As an approximation, we could break the total time interval into smaller time intervals and calculate the average velocity over each time interval. By multiplying each average velocity with its time intervals and adding them together, we estimate the total distance.

Suppose you visualise this and make the time intervals smaller and smaller. In that case, it is clear we are just calculating the area under a triangle, where time is the base and maximum velocity is the height of the triangle as it changes from zero to the maximum velocity in a straight line over time. In fancy language, we have gone from Riemann Sums to Calculus by integrating velocity over time. The displacement is then given by:

DISPLACEMENT = 0.5 X FINAL VELOCITY X TIME

In turn, the final velocity, given constant acceleration and zero initial velocity, is

FINAL VELOCITY = ACCELERATION X TIME

Hence,

TIME = FINAL VELOCITY / ACCELERATION

Substitute time into our displacement equation:

DISPLACEMENT = (0.5 X FINAL VELOCITY) X (FINAL VELOCITY / ACCELERATION)

We can rearrange the terms to get acceleration x distance on one side:

ACCELERATION X DISTANCE = 0.5 X FINAL VELOCITY SQUARED

Now the "Work Energy" expression becomes:

WORK ENERGY = 0.5 X MASS X FINAL VELOCITY SQUARED

So, the "0.5" comes from adding up speed over time to find out how far we have gone when we are speeding up at a constant rate from zero. This kind of speed-up gives us a straight-line increase in speed over time.

Now, let us reflect: If two things speed up to the same final speed but at different rates, will they have the same Kinetic Energy? The formula with "0.5" says yes, but the formula only works if it speeds up steadily. What if they do not? Then, we would need to use some more math (additional Calculus) to figure it out.

PROOF READ

The mass stays the same, but the speed-up does not. We know the push (or force) changes as we move. So, the push can change based on how far we have gone. This means to find out the work energy, we would need to add up the push over the whole distance we have travelled.

Hence, "Work Energy" is given by:

WORK ENERGY = INTEGRAL FORCE(DISTANCE) ALONG DISTANCE

**The brackets in Force(Distance) imply that Force changes with Distance. In general, Variable(Distance) implies Variable changes with Distance.*

As we assumed constant mass, we get:

WORK ENERGY = MASS INTEGRAL ACCELERATION(DISTANCE) ALONG DISTANCE

Using the definition of acceleration, we know that:

ACCELERATION(DISTANCE) = CHANGE VELOCITY(DISTANCE) OVER TIME

By substituting the above into Work Energy, we get:

WORK ENERGY = MASS INTEGRAL CHANGE VELOCITY(DISTANCE) OVER TIME ALONG DISTANCE

We can rearrange the expression using some mathematical knowledge to obtain:

WORK ENERGY = MASS INTEGRAL CHANGE DISTANCE OVER TIME ALONG VELOCITY(DISTANCE)

The definition of velocity tells us:

VELOCITY(DISTANCE) = CHANGE DISTANCE OVER TIME

The result is that:

WORK ENERGY = MASS INTEGRAL VELOCITY ALONG VELOCITY

By adding velocity over little bits of velocity, we are back to the area under a triangle when we start at zero velocity. The triangle now has a base going from zero to the final velocity, while the height is the final velocity:

WORK ENERGY = 0.5 X MASS X FINAL VELOCITY SQUARED

So, there is a "0.5" in our movement energy formula. This comes from adding up velocity changes when an object's mass does not change. We have learned the link between how things speed up and how far they go. The "0.5" in our formula is a part of this link.

PROOFREAD

There is still a lot more to learn. We can even connect our ideas to Einstein's famous Energy-Momentum formula. All these ideas are related, and we can understand them better if we think deeply and ask good questions.

Also, try to understand formulas without always plugging in numbers. Think about what happens to variables in a formula: are they squared or transformed by some trigonometric function? What is the range of values that the function outputs can have? There are also computer tools that can help you see how formulas work. These include programs like LibreOffice Calc, Python, and Octave. We will learn more about how to use these tools with our thinking method later.

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Math formulas can do many things. They can help guess results for unsure events, study how people behave, understand medicine side-effects, design better things, spot problems in data, predict crime or election results, measure false information effects, know when things might break or need replacing, create art and poems, learn languages, and even turn people into digital forms.

Master this understanding of values and variables in formulas, and you will be on your way to becoming a math wizard!

PROOF AD

5. SANITY CHECKS, ORDER ESTIMATES, AND THE BOTTOM LINE

IF I COULD REMEMBER THE NAMES OF THESE PARTICLES, I WOULD HAVE BEEN A BOTANIST

ENRICO FERMI

NOBLE LAUREATE AND QUANTUM PHYSICIST

Sanity checks, order estimates, and the bottom line is a simple strategy to find meaningful questions to ask, as well as assisting in developing useful evidence that needs to be understood and explained.

Sanity checks help you think about your work after you have finished doing your work. They make sure your Math or Physics answers make sense. Always use them to understand numbers better and to develop a feeling for numbers. They help you use common sense in everything you do and get better results.

When I was in my second year of university, I taught physics to first-year medical students. They were among the best high school students in the country. In a lab, they used a toy car on slopes with tape going through a timer. This timer made marks on the tape, which let them measure the car's speed. Part of the lab was to find out the car's average speed.

Many students made a big mistake, mixing up millimetres and meters. They said the average speed was 300 meters per second instead of 0.3. The mistake is forgivable, but it is not okay that they did not think about their answers and just believed it was right.

As their tutor, I asked them, "Are you sure about your answer?" They looked confused. I asked if their answers made sense to them. Every time, their reactions showed they were not used to thinking this way. Even though they were top students, they just believed their answers without questioning them.

PROOFREAD

Next, I asked them to guess how far 300 meters was and then wait for one second. Luckily, many understood their mistake, but some still did not. We talked more to make sure everyone got it.

This method was not always very popular because, after being corrected, many students responded that they were training to be doctors, not physicists. I insisted that these basic checks are important no matter the job you intend to do. Understanding basic numbers, like speed or dosage, is essential because mistakes can be dangerous.

Sadly, years later, a medical mistake almost harmed our daughter. She was about 3-4 years old and weighed about 20kg. During an emergency, the nurse mistakenly recorded her mass as 44kg, using the pound indicator on the scale instead of kilograms. The doctor started calculating the antibiotic dose meant for a child weighing 44kg. Luckily, my wife heard the wrong mass mentioned and quickly stepped in. She corrected the mass, saving our daughter. It was thanks to her attentiveness and quick thinking that a potential disaster was avoided. It was a scary moment.

Enrico Fermi, an Italian-American physicist, was known for "Fermi questions", which are about making rough or order estimates. He won a Nobel Prize in 1938 and taught eight students who also won Nobel Prizes. This shows how Fermi emphasised thinking deeply and reflecting critically on science, which led to many big discoveries. Reflecting critically on science has huge value and long-lasting effects.

Fermi's claim to fame was that he could make quick, rough estimates for strange questions: (we will adapt and extend some examples to make them relevant to 2023 and not 1938)

1. *What is the number of laptops in your town or city?*

2. *How many hairs are on your head?*

3. *How many e-mails are sent daily by students and staff at your school or university?*

4. *How many grains of rice are in a 50kg rice bag?*

5. *How many blades of grass are there on a rugby field?*

6. *How long would it take to count to a million?*

7. How much worth is a stack of coins as high as Mount Everest?

8. How many cups of coffee can a tin of instant coffee make?

9. How many Uber drivers are in your town?

10. How many Fermi questions were asked on the planet this year so far?

These questions are great for practising focused, thoughtful problem-solving. The answers can vary, but they help improve your number sense. This skill is vital for professionals like scientists, engineers, nurses, and doctors.

Another technique I like using is 'getting to the bottom line'. I typically approach this with my students as such, "After finishing homework or tasks, ask yourself: 'What did I learn from this?'" This method helps turn basic tasks into thoughtful learning. It is like the summary step in the Cornell Note-Taking System:

- 'Why did you do this homework or task?',

- 'What did you learn from it?',

- 'How does it connect to other tasks or lessons?',

- 'What's the main idea behind it?',

- 'Where else can you use what you learned?',

- 'What's the main point?'.

If you cannot answer these questions after thinking deeply, talk to your teacher about it. This is important for two reasons: to learn better and to make sure you are not given pointless tasks. Take a moment to think about this.

People who give tasks can make mistakes because they are under stress or have tight deadlines. Always question what you are given and do not just accept it. Do not just agree with your teacher out of respect. If something is not clear, discuss it with them. Talking about tasks can help improve future ones or give you a better understanding of current ones. Reviewing past tasks and asking meaningful questions can lead to new insights.

If you are a teacher and someone asks you these questions, first make sure the tasks have a purpose. Then, help them understand through conversation. Give hints rather than just answering so they can figure it out themselves.

Sometimes, teachers might not know the answer to a question, and that is okay. It is not about just knowing the answer but rather about how you find it. When this happens, teachers have a great chance to show students how to think critically and figure out the answer, emphasising the importance of the thinking process over just knowing facts.

Learning is about the journey, the way we think, and trying to find answers. It is important to encourage and grow this mindset - embrace it, foster it, and develop it.

PROOFREAD

6. FORCING QUOTES AND JOKES

> *THE BEST IDEAS COME AS JOKES. MAKE YOUR THINKING AS FUNNY AS POSSIBLE*
>
> DAVID OGILVY

A fun method to understand important topics that you learn is to turn them into short quotes or even jokes. This helps you focus on the main idea without getting overwhelmed. It is a playful way to unpack topics that might seem very daunting, plus these short statements can make it clear and easy for you and others to understand. In essence, it is the ultimate lesson taught.

Here is a recent joke I made about politics:

Why are there politics? Because there is incompetence.

It shows my sense of humour (or the lack thereof). Just reading a quote or a joke makes us think about how it relates to us. Turning ideas into quotes or jokes helps us think deeply in a creative way to get clarity. Quotes, in particular, are usually short and clear. They remove extra details and capture the main idea far better than long explanations could. Good quotes are often remembered easily and can be applied in many situations.

Quotes can have both good and bad sides. Some might be used to manipulate people for personal or financial reasons. But since they are short, it is easier to think about them and decide if we agree with their main message or not.

Think about Isaac Asimov's opinion on science, summarised in this quote:

> *SCIENCE DOES NOT PURVEY ABSOLUTE TRUTH; SCIENCE IS A MECHANISM. IT'S A WAY OF TRYING TO IMPROVE YOUR KNOWLEDGE OF NATURE. IT'S A*

SYSTEM FOR TESTING YOUR THOUGHTS AGAINST THE UNIVERSE AND SEEING WHETHER THEY MATCH

ISAAC ASIMOV

Thinking about the quote gives us insight into Asimov's views on science and its goals. Just like the ideas in "The Lost Art of Learning", both science and learning involve an iterative process to gain insight and understanding. Scientists repeat experiments and think about ideas, and learners go through cycles to turn doing and data into concepts they understand by thinking through them over and over again. Are there any differences between the two? If you think so, what do you think they mean?

A good quote can express big ideas clearly and motivate us to aim higher:

GOOD MARKETING MAKES THE COMPANY LOOK SMART

GREAT MARKETING MAKES THE CUSTOMER FEEL SMART

JOE CHERNOV

This is a great example of how companies can strive to make their businesses better by merely taking a quote such as this and "learn from their mistakes", reflecting on how they can do better to improve their customer experiences and hopefully feel an improvement on their profits.

Jokes are also a powerful tool to use to learn. Children do it often, almost unknowingly. I had to explain to my daughter the differences between the various types of physicists that one finds in the world. (She learned the word and needed to understand it).

As a student, this is how someone once explained it at university, so I shared it with her (tongue in cheek).

If you study **Biology**, you are considered a “squishy physicist". (Animals

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and blood and all sorts, right.)

If you study **Geology**, you are considered a "slow physicist". (Ok, I am not explaining each joke, but the earth's crust moves very slowly).

If you study **Computer Science**, you are considered a "virtual physicist".

If you study **Psychology**, you are considered a "people's physicist".

If you study **Chemistry**, you are considered an "impure physicist". (Ouch)

If you study **Mathematics**, you are considered a "unitless physicist".

And then I had to add that if you study **Mechanical Engineering**, you are considered an "engineering physicist". LOL.

These jokes give you a knowing smile, not just because it is funny, but because you understand its message. They are short and easy to remember, helping to gauge your understanding and making them relatable. How would you see other fields from your perspective?

Below, I am going to provide a few of my favourite quotes or jokes. In reading them, I would like you to reflect critically on the content of these quotes and jokes. What is their main message to you? How can we apply them to other situations? Can you improve or challenge them? How do they resonate with you?

SARCASM IS INTELLIGENT PEOPLE'S WAY OF DEFENDING THEMSELVES FROM THE LESS INTELLIGENT

UNKNOWN AUTHOR

ENERGY IS LIBERATED MATTER; MATTER IS ENERGY WAITING TO HAPPEN

BILL BRYSON

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IT DOESN'T MATTER HOW BEAUTIFUL YOUR THEORY IS; IT DOESN'T MATTER HOW SMART YOU ARE. IF IT DOESN'T AGREE WITH THE EXPERIMENT, IT'S WRONG

RICHARD P. FEYNMAN

IF THE UNIVERSE IS AN ARTIFICIAL SIMULATION, THEN MATHEMATICS IS ITS CODE, AND A PHYSICIST IS THE PROGRAMMER

SHUBHAM SANAP

PRIMITIVE LIFE IS VERY COMMON, AND INTELLIGENT LIFE IS RARE. SOME SAY IT HAS YET TO OCCUR ON EARTH

STEPHEN HAWKING

WHAT YOU GET BY ACHIEVING YOUR GOALS IS NOT AS IMPORTANT AS WHAT YOU BECOME BY ACHIEVING YOUR GOALS

HENRY DAVID THOREAU

THE CLOSEST PEOPLE COME TO PERFECTION IS ON AN EMPLOYMENT APPLICATION

UNKNOWN AUTHOR

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A COMMITTEE IS A GROUP OF PEOPLE WHO SPEND HOURS KEEPING MINUTES APPROVED IN SECONDS

UNKNOWN AUTHOR

THE BEST WAY TO PREDICT THE FUTURE IS TO CREATE IT

ABRAHAM LINCOLN

REMEMBER, NO ONE CAN MAKE YOU FEEL INFERIOR WITHOUT YOUR CONSENT

ELEANOR ROOSEVELT

YOU KNOW YOU'RE IN LOVE WHEN YOU CAN'T FALL ASLEEP BECAUSE REALITY IS FINALLY BETTER THAN YOUR DREAMS

DR. SUESS

CREATIVITY IS INTELLIGENCE HAVING FUN

ALBERT EINSTEIN

And just like Dr. Einstein said above, to use quotes, to use jokes, to make up quotes, to make up jokes, we are using the creative side of our brain. We are moulding and shaping information that is often very technical and linear and "colouring it in / outside of the lines" to learn better. To have fun and unknowingly embrace "The Lost Art of Learning" by thinking clearly and deeply, we are indeed exploring a bigger world of learning.

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As you read this book again, and I do hope you do, you will notice that some quotes change their meaning, some jokes change their humour, and other people might not understand what you understand the first time it is read. Do not worry; that is part of learning and growing. It served you the way you needed it for your brain to absorb it, and now that it is "part of you", the shift is clearer in your growth.

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7. ROLE-PLAYING AND SWAPPING

LIFE IS A ROLE-PLAY; ONLY IN ATTENTION ARE THE ROLES CHOSEN WISELY

ACHARYA PRASHANT

Role-playing and swapping is an immersive way to provide evidence that needs to be made sense of while allowing many different questions to be asked. They bring "The Lost Art of Learning" into social situations and help us see our hidden biases better. It can also be used with extremes and baselines for comparisons. Even for things that seem hard to measure, we can rank, which implies we measure. Role-playing and swapping reveal our prejudices by making us think from different viewpoints. It is about understanding others, learning, and being decent.

Let us talk about biases, especially social biases. This can be a touchy subject, and people have different opinions. What do you think about social biases? Are they good, bad, or maybe both? We can use role-playing to understand different viewpoints and think critically about them.

Let us imagine a scene filled with diverse people with various backgrounds going about their daily lives. Try to picture yourself as each person in this scenario. How does your perspective change as you switch from one person to the next? When do you feel comfortable, and when do you feel like you do not belong? When do you think you can achieve anything, and when do you feel stuck? Who do you relate to in this scenario, and who do you distance yourself from? Can you understand why?

In doing this exercise, we can uncover some of the negative effects of social biases, including:

...unfair treatment, inequality, discrimination, stereotyping, prejudice, oppression, etc....

Social biases can lead to divisions and discrimination that harm our communities. We must recognise these negative effects and challenge our

preconceived notions to build a fair and inclusive society. Doing so can promote understanding, dismantle discrimination, and create a more harmonious and respectful community.

Social biases can also limit our exposure to diverse perspectives and cultures, as some groups may isolate themselves for a sense of 'protection'. Shouldn't a fair and just society aim for equal treatment and opportunities, regardless of indifferent differences?

Other sets of social biases can also strengthen group bonds within a community. These biases can lead to a sense of belonging and unity, promoting cooperation and collective efforts for the group's preservation. Their strength in unity and cooperation can benefit society by enhancing their ability to address the challenges they face.

Biases, while simplifying complex information, may help make efficient decisions when information is limited. Recognising that these ideas are not exhaustive and reflect my biases is essential.

You can explore biases by assuming or swapping for roles representing various genders, races, ages, or backgrounds. Repeating this process may reveal new insights as you critically question and reflect on your observations to better understand others' experiences and challenges.

Role-playing and swapping help you understand and appreciate the various backgrounds and experiences of others, promoting empathy and perspective-taking. They also challenge stereotypes and assumptions and allow you to imagine yourself in someone else's shoes.

Role-playing engages your senses and emotions, creating an immersive yet critical reflection. Because it involves multiple senses, the lessons learned may be deeply ingrained and easier to remember.

You can use role-playing and swapping for various purposes, such as:

1. Career selection,

2. Building empathy,

3. Enhancing creativity,

4. Improving problem-solving,

5. Developing critical thinking,

6. Enhancing analytical skills,

7. Learning conflict resolution,

8. Improving negotiation abilities,

9. Making complex decisions,

10. Developing leadership qualities,

11. Building emotional intelligence,

12. Strengthening relationships,

13. Quick decision-making,

14. Boosting confidence,

15. Hands-on learning and more.

To practice identifying core concepts and ideas quickly under time pressure, you can use a role-playing exercise that simulates an urgent scenario requiring swift mastery of a new subject or skill. Here's how you could design such an exercise:

Scenario: Assume you're a consultant suddenly called upon to present a proposal on renewable energy solutions for a new client. The meeting is scheduled for one hour, and you need to quickly grasp the fundamental concepts of renewable energy technologies and market trends.

Preparation: Outline key areas you need to understand, including the types of renewable energy, benefits, major players in the market, and current technological trends.

Set a timer for one hour to simulate the time constraint.

Role Assignments:

Energy Expert: Responsible for understanding and explaining different types of renewable energy and their benefits.

Market Analyst: Focuses on market trends, key players, and potential growth areas in renewable energy.

Strategic Planner: Develop a concise strategy that aligns renewable energy solutions with the client's needs.

Client Representative: Thinks from the client's perspective, questioning the proposal's relevance and feasibility.

Rapid Learning and Summarisation: Spend 15 minutes researching each key area using reliable online sources. Then, take brief, focused notes on core concepts and ideas.

As the *Energy Expert*, summarise the essential details about each type of renewable energy (solar, wind, hydro, etc.).

As the *Market Analyst*, briefly list the latest trends and key players.

As the *Strategic Planner*, draft a strategic outline that leverages your newly acquired knowledge.

Simulated Presentation: Use the last 15 minutes to role-play a presentation to the client, switching between roles to present and then critically question the proposal. Each role should highlight what it has deemed to be core concepts and ideas and how these align with the client's interests and objectives.

Evaluation and Adaptation: Critically evaluate your presentation. Did you successfully cover the core concepts and ideas? Were you able to answer the Client Representative's questions convincingly?

Reflect on the effectiveness of your rapid learning technique. Did focusing on core concepts and ideas aid a better understanding and clearer presentation under pressure?

Improvement and Planning: Note any gaps in your knowledge or presentation skills that became apparent during the role-play.

Plan steps to improve your rapid learning ability and presentation skills under time pressure.

This exercise helps you quickly identify essential concepts and ideas and filter peripheral information. It also develops your ability to communicate

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these ideas effectively under pressure and to identify and relay the most critical information when time is of the essence.

Role-swapping, or role reversal, is often used in empathy training and conflict resolution to understand another person's perspective. Here's a quick example of how role-swapping can be used to resolve conflict between two people:

Situation: Two coworkers, Louis and Jamie, conflict because Louis feels that Jamie doesn't contribute enough to team projects.

Preparation: Louis and Jamie agree to participate in a role-swapping exercise to understand each other's perspectives better.

Role Assignment: Louis takes on Jamie's role, and Jamie takes on Louis's role.

Scenario Reenactment: They reenact a recent meeting where the conflict arose. Louis, playing Jamie, tries to express Jamie's thoughts and feelings during the meeting, perhaps highlighting pressures or misunderstandings that Louis might not be aware of. Jamie, playing Louis, expresses Louis's frustrations and expectations of team contribution.

Discussion: After the role-play, they discuss what they learned about the other's perspective. Louis might realise the additional pressures Jamie faces, and Jamie might understand Louis's concerns about team dynamics and productivity.

Reflection and Resolution: Using the insights gained from the exercise, they brainstorm solutions to improve their communication and collaboration, aiming to address the concerns from both sides.

This exercise can help both parties understand the underlying issues and emotions in the conflict, leading to more empathetic interactions and effective solutions.

When only one person is involved in a role-swapping exercise, the technique adjusts to become a solo reflection activity, where one attempts to place oneself mentally and empathically in another person's shoes. Here's a simple example to illustrate how you might use this method to understand someone else's situation better:

Situation: Suppose you are a manager, Themba, frustrated because a

team member, Nico, is consistently missing deadlines.

Self-Reflection: Begin by identifying your feelings and perceptions about the situation. Acknowledge your frustrations and expectations concerning Nico's performance.

Imagining the Other Role: Shift your perspective to imagine yourself as Nico. Consider possible reasons why Nico might be missing deadlines. Is it due to personal issues, misunderstanding of project priorities, overload of work, or something else?

Deep Empathy: Imagine yourself as Nico and consider what daily challenges, pressures, or constraints could affect his performance. Consider how he might perceive your reactions and management style.

Reflect on Insights: Return to your perspective and reflect on the insights you gained from imagining Nico's situation. What new understandings did you gain? How might Sam's feelings and challenges influence his behaviour?

Develop Solutions: Consider how you can address the situation using the insights from this role-swapping exercise. This might involve having a supportive discussion with Nico to understand his challenges better and develop strategies to improve his time management and performance collaboratively.

By mentally swapping roles and deeply considering the other person's perspective and circumstances, you can better understand their situation, leading to more empathetic and effective interactions and decisions.

Think about applying role-playing and swapping to develop each of the fifteen points.

Are there new points you want to add?

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X. CURRICULUM DESIGN

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COUNT THE NUMBER OF LESSONS LEARNED, NOT THE NUMBER OF EXAMPLES COMPLETED

THE AUTHOR

A curriculum is not just a bunch of classes you take one after another in school. It is supposed to be a well-designed learning path where each step connects to the next. You start with basic ideas and build on them as you go along. You start with basic ideas and build on them as you go along. You gradually develop basic reflection into critical reflection, deepening your thinking and enhancing the criticality of your questioning. Do not rush through a curriculum or try to do too much too fast. Ensure you allow time to develop sufficient understanding at each step before taking the next step.

This means teachers and students should constantly engage with one another about this learning path and give each other feedback to create a constructive learning environment and culture for both the teachers and the students. Such an environment is not common, but it should be the norm. This is an integral part of curriculum design, not only what to learn but how to learn.

We are moving towards a future where online education will surpass the traditional in-person learning model. With data-driven analysis and advanced computer modelling, we can tailor the educational experience to each individual and their needs at a massive scale. This means more personalised lessons, more personalised assessments, one-on-one tutoring, and tailored discussions in forums, all aimed at helping learners focus on reflecting with purpose and meaning.

Social interactions in learning will shift from physical campuses to public or shared online spaces. Traditional education's focus is changing. Instead of just providing content, it is becoming more about assessing and certifying competence. A key aspect in guiding students to learn well is designing assessments that value thinking and understanding instead of memorisation. Proper assessments gradually elevate the level and criticality of thinking as the curriculum progresses.

We need to understand the goal of a curriculum to ensure that real learning occurs, not just the appearance of learning or 'fake' learning. If you have too much material, you risk not completing it thoroughly. Therefore, they rush material, superficial assessments, and continuously build on poorly developed ideas, principles, and concepts. Applications and examples are limitless. Hence, curricula that focus on that almost always have too much to do and too little time. This is especially visible in Sciences, Engineering, Law, Medicine, and Ecology.

In example-driven curricula, learners are continuously confronted with

too much to do and too little time to do it. Overloaded with superficially understood content, these students continue to build on further superficial content (almost unknowingly). Each of these courses (to name a few) involves numerous examples, theories, details, etc., and it is often hard for learners to connect common concepts, principles, and ideas. Diverse and distinct applications cannot be generalised beyond the example.

Learners are often provided with extensive but mindless homework assignments in such curricula. Homework assignments that merely practice basic mechanistic and algebraic routines. These homework assignments and questions frequently repeat the textbook material and reduce thinking to follow memorised recipes and checklists. It creates a cycle where the student gets stuck doing repetitive tasks without understanding or thinking deeply. It puts the student at risk of only being able to generalise knowledge by mere memorisation and imitation but never appropriately understanding or internalising the material. The skills of meaningful reflection, grasping the concept, and critical thinking have a limited chance of blooming in such situations.

An essential lesson in curriculum design is that examples, details and specifics divide a curriculum.

In my opinion, the main goal of any curriculum should be to foster a profound understanding of concepts, ideas, and principles and not just regurgitate examples and assignments. Additionally, curricula should develop learners to **apply** these concepts, ideas, and principles to new situations, contexts, details, and examples. A concept-driven curriculum is limited to only a few main ideas, principles, and concepts. The generalisation of what is understood takes care of the applications, and whether only a limited or extensive number of applications are covered does not matter much, as the learners are equipped to generalise well-understood ideas to new contexts and applications.

When learners are presented with a curriculum from the start that develops understanding, they learn quickly. Their foundations are solid, and they no longer rely on superficial learning as they gradually develop their learning independence. Learners who develop this core and fundamental understanding truly begin to enhance their ability to generalise to new situations, scenarios, and applications when developed gradually. They take the concept and idea learnt earlier and apply it to newer problems more easily.

When learners are confronted with a limited number of well-thought-out examples and a limited number of homework assignments BUT they have a

clear purpose as to why - it allows learners sufficient time for purposeful reflection to obtain a profound understanding of the underlying concepts, ideas, and principles.

An essential lesson in curriculum design is that concepts, ideas, and principles unify.

"The Lost Art of Learning" exclaims, no pleas, with educators to include thought-provoking questions in homework assignments and assessments that encourage students to reflect purposefully on what they have done or been given to find meaningful clarifications focused on improving their understanding.

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To ensure an effective curriculum, it should include self-assessments as an integral part of the curriculum itself. These assessments are crucial to detect issues like 'fake learning', whether intentional or unintentional. One way to assess curriculum competency is through open-ended projects or research assignments that span multiple courses that the learner should complete independently.

This approach goes beyond coursework competence and helps identify problems like knowledge gaps or isolated concepts. It is a way to determine if changes or interventions, like teaching styles or learning methods, lead to meaningful rather than superficial understanding, which is often seen in poorly assessed coursework competency.

Assessments in a curriculum should focus on deepening the understanding of core concepts and ideas as learners progress towards more advanced courses and gradually develop their ability to reflect critically. This is especially crucial in the early stages of learning. These assessments should not always rely on calculations or routine tasks but should instead challenge students to grasp the deeper meaning of concepts and their implications. Rather than simply testing their ability to perform basic tasks, these assessments should encourage students to think about the "what if" scenarios or questions that require a deep understanding of the underlying concepts and ideas to answer correctly.

Current traditional educational systems focus on what they believe to be their core strength - teaching. Unfortunately, these systems often reward successful throughput so much that the teaching of the fundamentals gets lost. The teaching often aims to "teach" exams and assessment rewards for memorising past papers, which results in superficial learning. Online

educational ecosystems are challenging the role of traditional educational systems, often delivering quality content free of charge. Traditional educational systems are gradually becoming primarily in-person assessment authorities of freely available learning material. For their survival, they must ensure this is done with the highest quality and integrity that gradually develops actual learning.

In the future, just-in-time education and training will be the norm, helping workers adapt to changing markets and disruptions. Critical reflection and thinking will be crucial to stay competitive. Mastering "The Lost Art of Learning" will be essential because it helps you learn effectively in a focused manner, ensuring purposeful, continuous learning.

To thrive in the modern, educationally changing landscape, various institutions need to recognise their value in delivering meaningful learning. Those that do not will lose ground to scalable online education platforms like Khan Academy, Udemy, and Coursera, which offer well-structured content and clear delivery methods at low cost or for free. The challenge is not accessing content but learning and understanding it.

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Another relevant topic in curriculum architecture is understanding the difference between educators and learners. Ultimately, this boils down to how mature and critical their reflection skills are. I am both an educator and a learner because there are areas where I am an 'expert' and areas where I still need to learn. However, I prefer to view myself as only a learner as growth never stops, whether I am an 'expert' or not. By utilising places such as online courses and Massive Open Online Courses (MOOCs), I uncovered areas that I did not know that I did not know. Then, to walk the bridge from learner to 'expert' requires critical reflection. Remarkably, through focused studies and critical reflection, the traversal from learner to 'expert' is, as a matter of fact, even possible without having taken a single course in that field in which you could become the expert. This approach often delivers a fresh view of established ideas.

Whether new or experienced in self-study or online learning, the key to success for students of the future will lie in how well they reflect to understand and obtain clarity. One would think that graduates should have an advantage in this because they have completed degrees, but that is not always the case.

Many students struggle because they focus on memorisation rather than

understanding. They think they learn deeply when they only remember. Yet, how these students engage with the material and actively think about and process it makes them see real progress and success.

It is an important reminder that 'exceptional' learners learn not from doing homework but from processing the material until they understand it. 'Exceptional' learners can explain the ideas, concepts, and principles (either to themselves or their peers). Yes, they also might need time to digest complex concepts, principles, or ideas, but the key is that they can express what they have learned clearly and concisely.

'Average or struggling' learners often stop once they finish their homework, thinking they know, but in essence, they just memorised enough to get by. They took equally long (if not longer) to apply the same concepts, principles, etc., but their expression is mumbled, and they struggle to put concepts together and cannot explain. This should be the first clue that a limited learning iteration with the intent to understand and obtain clarity has taken place.

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Finally, as artificial intelligence and data science evolve, measuring a society's capacity for critical reflection on a large scale will become possible. Educational institutions and governments should aim to assess this. The differences in this ability can guide where more educational resources or interventions are needed. Data and clear facts should guide educational policies with a clear aim. Quantifying our capacity for critical reflection can bring rapid improvements to campuses, schools, countries, and societies.

Data can enhance learning by assessing how well learners reflect and then working to improve their performance. Online tools like tutoring platforms and chatbots can do this by asking thought-provoking questions, finding areas where learners need improvement, isolating those areas in discussions, and having meaningful generalisation discussions at scale.

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Looking at it from a curriculum designer's point of view, the key is to realise that everything in education is ultimately about encouraging practical and thoughtful questioning and developing the skill to clarify effectively. Critical reflection needs to be gradually developed as students progress through a carefully planned journey of concepts, ideas, and principles that gradually expand into specific areas of interest and practical applications. So, when

designing a curriculum, it is important always to ask: Does this promote critical reflection? How does it do that? And what can we do to enhance critical reflection?

> *TEACH YOUR CHILDREN HOW TO THINK AND NOT WHAT TO THINK*
>
> MARGARET MEAD

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A personal message to teachers:

Please do not give students examples without a clear purpose and lesson in mind. Ensure each example serves a specific purpose and that you can explain that purpose. Rather than giving too many examples, focus on making reflection meaningful and critical throughout the curriculum.

Help students appreciate concepts and principles by gradually teaching them how to apply these ideas in different situations. Use fewer examples and homework questions but focus on deep reflection and profound understanding instead of overwhelming them with many examples that only require memorisation.

This approach prevents students from gaining superficial knowledge and understanding and encourages meaningful learning.

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XI. ASSESSMENT

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WHAT YOU ASSESS DICTATES WHAT IS DELIVERED TO STUDENTS

HOW YOU ASSESS DICTATES WHETHER IT IS UNDERSTOOD OR REGURGITATED

THE AUTHOR

Checking how well someone understands something is key to helping them learn deeply, especially when they still need to mature. Good tests make students think hard, not just remember stuff. In school, many only learn to plug numbers into formulas. But, when they get to higher studies, they should consider the bigger picture: why they use certain formulas and what their results mean.

Sadly, many college courses only test basic math skills, even for hard topics. This is because grades are easy, and students feel good when they pass easily. They rate those teachers highly. But just calculating a number is not true learning. True learning is when they understand why it was computed, the implication of the answer, and when it is allowed to be computed in that way. A good way to test this is to give the result and answer, asking them to explain the result and apply sanity checks on whether they trust it or whether the result generalises to a different context. This makes them think about the ideas, concepts, and principles and why the answer matters.

Focus on why an answer is right or wrong, not just if it is. If students just guess, they might pass without really learning anything. For math problems, think about including questions:

1. What does the sign of your answer mean?

2. What happens to your answer if you change some numbers a bit?

3. Why does it change like that?

4. Are the numbers what you thought they would be?

5. Where did you think the smallest and biggest numbers would be?

6. Can you think of real-life examples that match your answer?

7. Can you use your answer in different situations?

8. What is the farthest situation from your problem where your answer still works?

9. When does your answer not work, and why?

10. What are the units of the numbers, and what implications does physics invoke?

When students solve a problem, they should also question their answers and be sure why their answer is correct.

After you solve a math problem, pretend someone else gave you the question and the answer. Without looking at your work:

1. Do you believe the answer is right? Why?

2. Can you estimate the answer differently?

3. Do you see any patterns if you change some numbers?

4. Is your answer in the right order of magnitude?

Encourage students to think of the question as a riddle. Let them try to solve it in ways different from what they were taught. Let them articulate the main lesson and understanding behind the question. By thinking deeply and exploring creatively, they will learn and become better thinkers.

Sometimes, questions can ask students to pick the right formula or idea. They might also need to use the correct information when too many options are available. Some options might have too much, too little, or wrong information. This makes students think deeply about what they know.

Another way is to ask questions about patterns or behaviours, not just calculations. For example, ask, "What if we change this? What happens and why?" Or compare two situations and ask what is similar or different and why.

It is better to test how well students understand ideas than how fast they can calculate. Understanding lasts a lifetime, but quick calculations go rusty directly after a test. Schools should focus on developing students' ability to question purposefully and then systematically clarify meaningfully.

Surprisingly, not all schools, colleges, and universities do this.

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XII. PROGRAMMING GYM

THINK TWICE, CODE ONCE

WASEEM LATIF

Talking about programming and "The Lost Art of Learning" might seem strange. But both are about breaking down complex things into simpler parts. With programming, you take a big problem and break it down step by step until it is easy to code. These simple pieces of code are then put together to make things complex again but in a structured way.

For me, programming is a way to be creative. I can make new things, solve problems, and change systems as I see fit. I use my imagination but am also limited by what the coding language allows. I have taught programming to lots of engineering students. I used to tell them that it is similar to design engineering: both are about solving problems using limited tools.

One great thing about programming is that you see results fast. Within hours, you can solve many small problems. Breaking down problems in this way helps you think better and understand systems more deeply. How you solve the problem might look different depending on which coding language you use. But no matter the language, programming can teach you to think critically if you approach it with the right attitude.

Here is why computer programming is beneficial:

1. Programming helps you solve problems. Like John Johnson said, "first solve the problem, then write the code".

2. In just one day, you can create many programs for different tasks.

3. It makes you focus and work hard, especially with languages like Assembly and C++.

4. When you make mistakes, the computer tells you without any bias.

5. After solving one problem, you feel energised to solve a tougher one.

6. Programming is similar to engineering in how you think and solve problems. It exercises your brain to think critically. If you are looking to understand math problems deeply, programming can help. You can set up simulations to explore ideas.

Programming is like a workout for your brain, especially when you are trying to find new and creative solutions. Even when trying to solve a simple problem, you can use programming to simulate and test solutions easily. This is helpful so you do not get stuck on basic math problems. Hence, programming effectively provides results you need to make sense of, thereby enhancing your understanding.

When you use programming to do homework, you can think deeply, ask questions, and see if your ideas work by running the code repeatedly after making small changes to answer your crafted questions.

There are different types of programming languages. Some, like C, C++, or Fortran, take time to get ready to run. This waiting time makes programmers think more deeply about their code. Others, like Octave, MATLAB, Basic, and Python, give feedback quickly. This can make you try things without thinking much, but you will still learn. When there are errors, you need to understand them, fix them, and make sure your program works. Playing around with the code and seeing how changes affect results can help you understand concepts better.

Thinking deeply is important to understand how your early choices in coding will affect the code later on, like when you are updating or changing it. You also need to make sure your solutions are right. However, just because someone is good at coding does not mean they always think deeply about other things. Some coders might code without fully understanding the problem. However, being creative and thinking about the results while coding can help you think more critically. Remember, you decide how much you want to think about your actions.

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Here are some online tools for learning to code:

1. **Kodable**: A tool for young kids to learn coding even if they cannot read yet - https://www.kodable.com

2. **Scratch**: A free place for kids to make games, stories, and animations - https://scratch.mit.edu

3. **LightBot**: A game that helps you learn coding logic - https://lightbot.com

4. **Hour Of Code**: Offers coding lessons and activities for all ages - https://hourofcode.com/ca

5. **Code.org**: Teaches coding to change the world, starting from basics to more advanced - https://code.org

> *EVERYBODY SHOULD LEARN TO PROGRAM A COMPUTER BECAUSE IT TEACHES YOU HOW TO THINK.*
>
> STEVE JOBS

Always remember to think deeply, not just when you are practising.

> *YOU MIGHT NOT THINK THAT PROGRAMMERS ARE ARTISTS, BUT PROGRAMMING IS AN EXTREMELY CREATIVE PROFESSION. IT'S LOGIC-BASED CREATIVITY.*
>
> JOHN ROMERO

PROOFREAD

XIII. EMOTIONAL REGULATION

PROOFREAD

LEARNING IS A GIFT, EVEN WHEN PAIN IS YOUR TEACHER

JAMES GARNER

Kids are born curious and love to learn without fearing mistakes. As they grow up, they start worrying about being right or wrong, especially if they are made fun of or scolded for their mistakes. This fear can make them less eager to try and learn new things.

Some teachers make this worse by making kids feel bad for being wrong. This is not because of the student's mistake but because of the teacher's emotional issues. Instead of putting someone down, it is better to let them understand the mistake, learn from it, and develop them to avoid it in future. However, that needs effort and understanding from the teacher.

Questioning means taking chances. When we question, we admit we might not have all the explanations. So, we need to be okay with not always knowing. If we are not careful, we might believe something untrue. Richard Feynman once said something about this:

> *IT IS MUCH MORE INTERESTING TO LIVE NOT KNOWING THAN TO HAVE ANSWERS THAT MIGHT BE WRONG*

It is okay to feel bad when we are wrong. But as we get better at thinking deeply and controlling our feelings, these bad feelings will disappear faster. It is important to be happy about what we learn and not focus on the bad feelings. We need not take learning too personally; we can only grow when iterating by reflecting.

> *IT IS NOT PERSONAL. IT IS FACTS*
>
> UNKNOWN AUTHOR

When you think deeply, you either discover that you are right or fix what is wrong. Controlling your emotions helps you grow because it allows you to deal with your feelings healthily and focus on what matters.

To start controlling your emotions, you need to be aware of them. Once you know your feelings, you can figure out why you feel that way. This helps you put a name to your emotions. When you can name it, you can control it. It lets you take a moment to calm down and think about your feelings differently. Here are some aspects to be mindful of, which you can apply

when your emotions get the better of you:

Breathing deeply can help you relax when you are stressed. Breathe in slowly through your nose and out through your mouth. This helps your brain think clearly.

Box breathing is another breathing technique that works really well in stressful situations. You breathe in through your nose for the count of 4, then hold your breath for the count of 4, exhale through your mouth for the count of 4, and hold your breath again for the count of 4. You repeat this until you feel calmer.

Reappraisal means examining a situation from a different viewpoint, such as seeing a difficult task as a chance to learn.

Re-evaluation considers whether your feelings match the situation or how past events affect your reaction.

Repurposing is using your feelings positively, like using anger to exercise.

Rephrasing is about changing how you talk to yourself. Instead of saying, "I cannot do this," say, "This is tough, but I will try step by step."

Try different ways to handle your emotions and see which ones work best. "The Lost Art of Learning" can help you deal with emotions you would rather not feel. We can better handle our feelings, not just when we are learning but also when we are around others.

Sometimes, after an argument, you might feel confused or not care. This could be because you are making false equivalences, which means you are comparing different things. For example, apples and oranges taste the same because they are both fruits. "The Lost Art of Learning" can help you notice when you make these mistakes so you do not have to feel upset.

Unfortunately, people often use false equivalences in politics to confuse or divide others for personal gain. This can make debates about things like freedom of speech and censorship tricky because the arguments might seem right initially. If we are not careful, false equivalences can trick us.

We cannot dictate the motives, misrepresentations, insecurities, and falsehoods of others, but we can apply "The Lost Art of Learning" to dictate how it impacts us. Part of life is the painful journey of deceit, disappointments, indifference, challenges, and obstacles, and the delight in

our growth as we are exposed to, deal with and learn to overcome them.

Life has both good and bad moments. Some people see only the bad parts, others see only the good parts, and some try to understand and learn from both.

People tend to focus more on bad things than good ones. This might be because of how humans evolved; paying attention to danger was important for survival. We remember and learn from bad experiences more than good ones, but we can also find good lessons in bad experiences. Because of our natural tendencies, we need to think actively and not passively focus on the negatives.

"The Lost Art of Learning" helps us learn from good and bad moments. This skill helps us stay strong during hard times and be grateful during good times. While you cannot change the past, you can choose how it affects you. Always watch where you put your attention and energy.

WHAT WE DWELL ON IS WHO WE BECOME.

OPRAH WINFREY

◆◆◆

Like any skill, critical reflection and thinking can be used for good or bad reasons. Some people use it wrongly in things like online crimes. They use tricks to find easy targets. Some online scams use emails with clear mistakes on purpose. This helps them find people who do not think deeply because they ignore the errors. It is harder to trick someone who thinks carefully. Big companies like Cambridge Analytica misused personal data for political reasons. Another company, Bell Pottinger, spread false stories and hate in South Africa, causing a lot of harm. They almost ruined the country's progress of 25 years in just two years.

Wars today are more about spreading misinformation than physical fighting. Instead of soldiers fighting each other, now people and computer programs battle with information online. Social media and news platforms play a big role in this. We have too much information, which can confuse us

and reduce our ability to think clearly. Fake news can seem real, while true information might be hidden or made to look false.

Too much information can stress us out, reduce work speed, and harm our health, especially when we cannot tell what is true. Misinformation can damage communities. We need to think deeply about and question the information we get. "The Lost Art of Learning" reminds us to understand better, helping us to manage our feelings.

Many mental health issues today come from not sorting through and understanding information properly. Self-deception is another cause for mental health concerns, where people consciously engage in dishonest behaviour to make up for their lack of understanding or inability to understand properly.

Your choices affect others just as theirs affect you. Make good decisions and treat people, especially learners, with kindness and respect; they are your children's teachers. Encourage their questions and curiosity so they continue to love to learn and do not lose that passion.

LEARNING IS THE ONLY THING THE MIND NEVER EXHAUSTS, NEVER FEARS, AND NEVER REGRETS

LEONARDO DI SER PIERO DA VINCI

PROOF READ

XIV. LEADERSHIP

PROOFREAD

THERE BUT FOR THE GRACE OF GOD, GOES JOHN BRADFORD

JOHN BRADFORD

In 1987, Warren Bennis and Burt Nanus introduced the term VUCA to describe our unpredictable and complicated world. VUCA stands for Volatile, Uncertain, Complex, and Ambiguous. It is a key concept in leadership training. Bill George expanded it to VUCA 2.0, emphasising Vision, Understanding, Courage, and Adaptability. Today, things like advanced AI highlight the need for everyone to deal with this VUCA world.

Leading in a challenging (VUCA) world needs continuous reflection with the intent to adapt and find opportunities as new information becomes available and as landscapes change. Regular reflection with intent helps to handle change better as resources and approaches are adapted to potential and likely risks.

When we do not understand something, it can seem unclear or vague. Critical reflection helps us recognise and deal with this uncertainty by clarifying the right questions to improve our oversight and foresight. It clears up the confusion by finding the correct information. Through thoughtful reflection, we can plan for more likely outcomes based on evidence rather than solely guessing on our gut. While purposeless exploration can sometimes work, it is not always the best way and can lead to slow results or poor outcomes.

Reflection with intent helps to properly evaluate situations using actual evidence and data, not just rumours or stories. It helps separate problems caused by a lack of information from those that are naturally complex. This leads to better decisions, even under pressure. It focuses on solving problems due to missing information and accepts the natural complexity of some processes. Reflective thinkers see different perspectives and simplify complicated issues to understand the core principles clearly. This helps them prioritise and ensure the right tasks are given to the right people at the right time. Reflection with intent avoids wasting time on aspects that do not matter or are out of our control, elegantly stated as follows:

> *WHEN YOU STOP WORRYING ABOUT WHAT YOU CAN'T CONTROL, YOU HAVE TIME TO CHANGE THE THINGS YOU CAN CONTROL*
>
> *UNKNOWN AUTHOR*

Managers sometimes focus on personal gains, harming the team's morale and trust. This can make team members feel used and lead them to work only for their benefit. Managers might use fear or manipulation to control their team. On the other hand, good leaders motivate and inspire their team. They lead with honesty, responsibility, and confidence. This makes the team want to work together towards a common goal. Even after the leader is gone, the team continues to succeed because of the strong foundation the leader built. John C. Maxwell differentiates managers and leaders by whether they focus on personal success or the success of the group:

> *A SUCCESSFUL PERSON FINDS THE RIGHT PLACE FOR HIMSELF. BUT A SUCCESSFUL LEADER FINDS THE RIGHT PLACE FOR OTHERS*
>
> *JOHN C. MAXWELL*

The world faces a leadership crisis today. Many decision-making roles are filled with managers focused on self-preservation rather than visionary leaders. From politics to education, we see more and more managers and less and less leaders. Weak leaders often surround themselves with less competent people, while great leaders empower the best to handle vital tasks. This trend harms organisations in the long run due to poor decisions and actions made by the least competent. The effects of this leadership gap are impacting everything from businesses to schools and will continue to do so in the future. Many anonymous memes, quotes, and jokes highlight the differences between managers and leaders:

> *LEADERS HAVE PEOPLE WHO FOLLOW THEM, WHILE MANAGERS HAVE PEOPLE WHO WORK FOR THEM*

> *LEADERS CREATE A VISION, WHILE MANAGERS CREATE GOALS*

> *LEADERS ARE ADMIRED, AND MANAGERS ARE*

FEARED

MANAGERS ENSURE THINGS ARE DONE RIGHT; LEADERS ENSURE THE RIGHT THINGS ARE DONE

MANAGERS PERSUADE PEOPLE TO DO THINGS THEY DO NOT WANT, AND LEADERS INSPIRE PEOPLE TO DO THINGS THEY NEVER THOUGHT THEY COULD DO

Leaders question and clarify with intent, while managers follow policies and rules. With advancing technology and AI, the value we add is shifting from just doing tasks to critically questioning our actions to ensure value is added as we adapt to changes.

Critical reflection lets us understand the world and choose our path through it.

PROOFREAD

XV. GENERATIVE AI'S VIEW ON LEARNING

PROOFREAD

GENERATIVE AI IS THE MOST POWERFUL TOOL FOR CREATIVITY THAT HAS EVER BEEN CREATED. IT HAS THE POTENTIAL TO UNLEASH A NEW ERA OF HUMAN INNOVATION

ELON MUSK

In the last year, the world has been taken over by the ever-amazing, slightly scary, and yet exciting ChatGPT. It created a loud buzz and had industries and companies on edge as the reality and sustainability of their jobs and the value they add came into serious question.

For those who want the lower-level explanation, ChatGPT is a Chat Generative Pre-Trained Transformer, which is a large language chatbot developed by OpenAI. It launched on 30 November 2022, just as the world recovered from the COVID pandemic. Through a web interface, you can have a conversation with ChatGPT to assist you with matters of importance. For example, you can ask it a question, "Hi ChatGPT, write a short poem for me about the sunsets over Stonehenge." It creates a poem about the topic. The first version of this poem might be considered "slightly primitive". But you can guide it to focus more on specific aspects and to remove aspects that you do not like. As more and more people engage with ChatGPT to provide better information, it collects data. It continuously reflects through neural network mechanisms and online training to provide "wiser" and "more meaningful" answers.

So, I thought it an interesting experiment to see how the world of Generative AI interprets the world of learning. How does it understand learning to take place? What does it consider effective learning to be? And how much of what the world is still searching for "The Lost Art of Learning"? Is the world still lost in formal definitions of learning and lists of options, or has it conceptualised learning to its core? Is the focus on doing and not comprehension?

Let us look at ChatGPT 3.5 and 4.0's perspectives on learning and compare their ideas with those proposed in this book.

Using the given prompt:

What is the essential ingredient for learning?

Here is what **ChatGPT 3.5** said:

THE ESSENTIAL INGREDIENT FOR LEARNING IS CURIOSITY. CURIOSITY IS THE INNATE DRIVE TO SEEK KNOWLEDGE, UNDERSTAND THE WORLD, AND SOLVE PROBLEMS. IT IS THE SPARK THAT IGNITES THE LEARNING PROCESS AND KEEPS IT GOING. HERE IS WHY CURIOSITY IS SO CRUCIAL FOR LEARNING:

(It then goes on to list several points, which we will address shortly).

But in a matter of months, here is what ChatGPT 4.0 said:

THE ESSENTIAL INGREDIENT FOR LEARNING IS A TOPIC OF SUBSTANTIAL DEBATE AND RESEARCH AMONG EDUCATORS, PSYCHOLOGISTS, AND NEUROSCIENTISTS. WHILE MANY FACTORS ARE IMPORTANT FOR LEARNING, THE FOLLOWING ARE COMMONLY IDENTIFIED AS KEY INGREDIENTS:

It is interesting to note how the definition in version 4.0 sounds a lot more clinical, a lot more scholastic, and how version 3.5 embraces the child-like nature of learning and calls it "curiosity", which is much more aligned with the "Lost Art of Learning" but still lacks focus, purpose and depth of understanding. Curiosity is often associated with exploring new ideas shallowly, as ChatGPT 4.0 clarified in its list of key ingredients.

The definitions then go further to provide key ingredients as to how it identifies learning.

In **ChatGPT 3.5**, these are some of the essential ingredients that were listed to answer the question about learning:

MOTIVATION: CURIOSITY SERVES AS A POWERFUL INTRINSIC MOTIVATOR. WHEN YOU ARE CURIOUS ABOUT A TOPIC OR QUESTION, YOU ARE NATURALLY MOTIVATED TO EXPLORE AND FIND ANSWERS. THIS MOTIVATION KEEPS YOU ENGAGED IN THE LEARNING PROCESS.

ENGAGEMENT: CURIOSITY MAKES LEARNING ENJOYABLE. IT ENCOURAGES ACTIVE PARTICIPATION AND EXPLORATION, WHICH ENHANCES YOUR ENGAGEMENT WITH THE SUBJECT MATTER. WHEN YOU ARE CURIOUS, YOU ARE MORE LIKELY TO ASK QUESTIONS, SEEK INFORMATION, AND EXPERIMENT.

RETENTION: CURIOUS LEARNERS TEND TO REMEMBER INFORMATION BETTER. WHEN YOU'RE GENUINELY INTERESTED IN A TOPIC, YOUR BRAIN IS MORE LIKELY TO ENCODE AND STORE THAT INFORMATION FOR LATER USE. CURIOSITY CAN IMPROVE MEMORY AND LONG-TERM RETENTION.

PROBLEM-SOLVING: CURIOSITY DRIVES PROBLEM-SOLVING. WHEN FACED WITH A CHALLENGE OR A QUESTION, A CURIOUS MINDSET ENCOURAGES YOU TO EXPLORE DIFFERENT SOLUTIONS AND APPROACHES. IT FOSTERS CREATIVITY AND CRITICAL THINKING.

LIFELONG LEARNING: CURIOSITY IS A KEY DRIVER OF LIFELONG

LEARNING. IT ENCOURAGES YOU TO CONTINUE SEEKING KNOWLEDGE AND EXPLORING NEW INTERESTS THROUGHOUT YOUR LIFE. LIFELONG LEARNERS OFTEN FIND JOY IN THE PROCESS OF DISCOVERY.

ADAPTABILITY: CURIOSITY HELPS INDIVIDUALS ADAPT TO NEW SITUATIONS AND CHANGES. IT ENCOURAGES A GROWTH MINDSET, WHERE CHALLENGES ARE SEEN AS OPPORTUNITIES TO LEARN AND IMPROVE. THIS ADAPTABILITY IS CRUCIAL IN OUR RAPIDLY CHANGING WORLD.

BROADENING PERSPECTIVES: CURIOSITY CAN LEAD TO A BROADER UNDERSTANDING OF THE WORLD AND DIFFERENT PERSPECTIVES. IT ENCOURAGES EMPATHY AND OPEN-MINDEDNESS BY MOTIVATING YOU TO EXPLORE DIVERSE VIEWPOINTS AND EXPERIENCES.

In summary, while various factors, such as effective teaching methods, resources, and a supportive learning environment, play important roles in the learning process, curiosity is the driving force behind it all. Cultivating and nurturing curiosity is essential for both formal education and lifelong learning, as it propels individuals to explore, discover, and grow intellectually and personally.

In **ChatGPT 4.0**, these are some of the essential ingredients that were listed to answer the question about learning:

MOTIVATION: AN INTERNAL DRIVE OR REASON TO LEARN. WHEN LEARNERS ARE MOTIVATED, THEY ARE MORE LIKELY TO ENGAGE WITH MATERIAL, PERSIST THROUGH CHALLENGES, AND ACHIEVE DEEPER UNDERSTANDING.

CURIOSITY: A NATURAL DESIRE TO KNOW OR LEARN SOMETHING. CURIOSITY CAN DRIVE LEARNERS TO EXPLORE NEW TOPICS AND SEEK ANSWERS TO QUESTIONS, LEADING TO A DEEPER AND MORE MEANINGFUL LEARNING EXPERIENCE.

ATTENTION: THE ABILITY TO FOCUS ON SPECIFIC INFORMATION OR TASKS IS CRUCIAL FOR PROCESSING AND RETAINING NEW INFORMATION.

FEEDBACK: RECEIVING FEEDBACK, WHETHER IT IS FROM INSTRUCTORS, PEERS, OR SELF-ASSESSMENT, HELPS LEARNERS IDENTIFY AREAS OF STRENGTH AND WEAKNESS, ADJUST STRATEGIES, AND SOLIDIFY UNDERSTANDING.

REPETITION: THE PROCESS OF REVIEWING OR PRACTICING MATERIAL

OVER TIME, OFTEN REFERRED TO AS "SPACED REPETITION," HELPS CONSOLIDATE INFORMATION INTO LONG-TERM MEMORY.

ACTIVE ENGAGEMENT: ACTIVE PARTICIPATION IN THE LEARNING PROCESS, SUCH AS THROUGH PROBLEM-SOLVING, DISCUSSION, OR TEACHING OTHERS, OFTEN RESULTS IN BETTER RETENTION AND UNDERSTANDING THAN PASSIVE RECEPTION OF INFORMATION.

A SAFE LEARNING ENVIRONMENT: A SPACE WHERE LEARNERS FEEL PHYSICALLY AND EMOTIONALLY SECURE CAN MAKE A SIGNIFICANT DIFFERENCE. WHEN LEARNERS ARE NOT ANXIOUS OR FEARFUL, THEY ARE MORE OPEN TO LEARNING.

PRIOR KNOWLEDGE: BUILDING ON WHAT ONE ALREADY KNOWS CAN FACILITATE THE LEARNING OF NEW INFORMATION. MAKING CONNECTIONS BETWEEN NEW MATERIAL AND EXISTING KNOWLEDGE CAN HELP IN UNDERSTANDING AND RETENTION.

METACOGNITION: UNDERSTANDING ONE'S OWN LEARNING PROCESS AND BEING AWARE OF HOW ONE THINKS CAN HELP LEARNERS ADAPT AND ADOPT STRATEGIES THAT WORK BEST FOR THEM.

RELEVANCE: WHEN LEARNERS SEE THE RELEVANCE OR PRACTICAL APPLICATION OF WHAT THEY'RE LEARNING, THEY'RE OFTEN MORE MOTIVATED TO UNDERSTAND AND REMEMBER IT.

IT IS IMPORTANT TO NOTE THAT THE "ESSENTIAL" INGREDIENT CAN VARY BASED ON THE INDIVIDUAL LEARNER, THE CONTEXT, THE TOPIC BEING LEARNED, AND OTHER FACTORS. EFFECTIVE LEARNING IS MULTIFACETED AND LIKELY REQUIRES A COMBINATION OF MANY, IF NOT ALL, OF THE INGREDIENTS MENTIONED ABOVE.

It was interesting for me to observe the following between the two sets of answers:

1. Both talk about motivation and how it is critical to stay engaged with the material.

2. Engagement changed to active engagement, but with different interpretations of the word engagement.

3. Retention changed to attention, while curiosity drove retention in version 3.5; repetition drives retention in ChatGPT 4.0's response.

4. In ChatGPT 4.0, curiosity became an ingredient in a list of things and was no longer the driver behind learning, as per ChatGPT 3.5.

5. And then, the perception of a 'deeper understanding' of learning evolved from ChatGPT 3.5 to ChatGPT 4.0, with a longer list of key ingredients that include 'safe learning environment', 'feedback', 'relevance', 'prior knowledge', and 'repetition'.

It made me think of a quote,

> *THOSE WHO CAN MAKE YOU BELIEVE ABSURDITIES*
> *CAN MAKE YOU COMMIT ATROCITIES*
>
> *VOLTAIRE*

Yet, neither clearly grasped the primary concept behind learning. Although curiosity is aligned, it lacks purpose, focus, depth of understanding, and potentially the iterative process of learning. The key to learning is more than just a checklist of high-level definitions that need to be accomplished to learn better.

Learning is the focused process of posing purposeful questions that require meaningful explanations. It is almost as if "The Virtual Art of Learning" is still lost and needs to find its way back.

PROOFREAD

XVI. CONTINUATION

PROOFREAD

THE BEST WAY OUT IS ALWAYS THROUGH

ROBERT FROST

In learning, there are seldom true endings—only deeper understanding, more profound insight, and new beginnings. This book culminates with a 'Continuation' chapter rather than a 'Conclusion' chapter to underscore the perpetual journey of personal development. Growth, discovery, and self-realisation are never finite. By framing the last chapter as a continuation, you are invited to internalise these teachings not as a definitive endpoint but as a launching pad.

Throughout this journey, we have delved into numerous concepts, techniques, and strategies. Yet, the essence remains: when you reflect with intention, focusing on this one pivotal idea, you unlock doors you never knew existed. However, understanding this is just the beginning; the rest of the work, the real transformation, lies squarely on your shoulders.

The world may provide the tools and the knowledge, but the learning culture you create with them is entirely up to you. Dedicate yourself and watch as your learning tapestry unfolds in ways you had never imagined, as true growth arises not from the accumulation of knowledge but from the consistent application of a singular insight.

Embrace simplicity, reflect with intention, and witness the profound impact of bringing one idea to life. The ideas within these pages are not meant to offer closure but rather to open doors, ignite curiosity, and inspire onward movement. Our story, your story, doesn't end here; it evolves, transforms, and persists as you develop.

Facing your fears is a testament to your inner strength and resilience. It is not about eradicating the fear but about standing tall in its midst, acknowledging its presence, and choosing to move forward regardless. Every time you confront what scares you, you are crafting a legacy of courage, proving to yourself that limits are often just illusions. Embrace each challenge as an opportunity to grow, for on the other side of fear lies freedom, a realm where your true potential is realised and dreams are manifested.

Embrace the learning journey ahead with the knowledge that learning is a continuous adventure, and you are its intrepid explorer.

PROOFREAD

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LEARN TO QUESTION SO THAT YOU CAN QUESTION TO LEARN

THE AUTHOR

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EPILOGUE

HINDSIGHT TO FORESIGHT

PROOFREAD

TO FULFILL YOUR VISION, YOU MUST HAVE HINDSIGHT, INSIGHT, AND FORESIGHT

IFEANYI ENOCH ONUOHA

Highlighting the core of learning through questioning and thoughtful clarification allows us to target and harness it effectively. Critical reflection, vital for learning, is frequently missed. It should be the absolute cornerstone of every teacher and every learner, yet many are unaware of it.

By stressing its significance, I hope it becomes central to parenting, education, and online learning. This way, future generations can move from looking back with regret and ahead with the vision to proactively shape and navigate their future.

What sets humans apart from other animals (and machines such as ChatGPT) is the maturity of our ability to reflect critically with focus and intent to improve our understanding and to define meaning. We did not climb the evolutionary ladder due to physical strength or agility but through our ability to adapt using critical reflection. As we evolve, reflection develops our brains as we overpower primal instincts through evolution. One day, the evolutionary statuses of species may be quantified by their capacity and maturity to reflect critically.

The unwritten chapters of this book are for you to write. While many topics related to "The Lost Art of Learning" were not covered, I shared a foundation. Now it is your turn to build on that foundation, to apply and explore deeper into this journey of questioning and clarifying with intent and to discover an '*art of learning that is no longer lost*'.

As you hone your critical reflection skills, you will turn past lessons into future insights. Develop habits like journaling, gratitude practices, reviewing and critiquing, yes even this book, and forming your questioning and clarification strategies. Make "The Art of Learning" a natural part of your life.

ALL THINKING BEGINS WITH WONDERING

SOCRATES

We need a movement of critical reflection to foster community, sustainability, respect, tolerance, honesty, and sincerity. Join the "The Art of Learning" club and create a thoughtful and compassionate world.

If this book helped you - share it - it can change someone else's life.

ABOUT THE AUTHOR

Daniel N. Wilke

Daniel N. Wilke is a Full Professor in the leading Mechanical Engineering Department in Africa. His research interests are focused on generative mathematical modelling and engineering optimisation for design and data science.

He is currently serving in various roles within his industry, such as the President of the Society of Theoretical and Applied Mechanics (SAAM), the National Chairman of the International Union for Theoretical and Applied Mechanics (IUTAM), and Associate Editor for Computer Modeling in Engineering & Sciences.

He co-authored "Practical Mathematical Optimization: Basic Optimization Theory and Gradient-Based Algorithms" (2nd Edition), No. 133 in Springer Optimization and Its Applications, Springer, 2018, with Prof. Jan A. Snyman.

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